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Joining the West to the East

THE San Francisco convention of the National Electric Light Association will long be remembered by the companies on the Pacific Coast as well as by the delegates from east of the mountains, not because of attendance—for, reflecting the unsatisfactory industrial conditions, it was not over-large—nor yet because of some very excellent papers presented, but chiefly because the natural barrier separating one section of the country from the other no longer detracts from the work of the association. For the past two years there has been a feeling of dissatisfaction on the part of the companies west of the Rockies with certain phases of the work of the national body, and this was at one time so acute as almost to cause the Pacific States companies to withdraw. The convention just closed has been the means of clearing up all misunderstandings, and now all sections of the association are one in heart and purpose. Rubbing elbows together, the East has learned much from the West and has imparted just as freely as it has received. Ample provision was made for the discussion of problems peculiar to the Pacific Coast, which enabled delegates from other parts to appreciate probably as never before the pioneer work and spirit of the men engaged in the generation and distribution of electricity over long distances. On the other hand, Western companies obtained a fuller comprehension of the highly specialized commercial work done in the East. That more sessions were devoted to the consideration and discussion of purely commercial problems than to any other, and that these sessions were best attended, reflects the trend in the industry. The very excellent public-policy meeting topped all else in importance, while enthusiasm reached its climax in the celebration of the "N. E. L. A. Day" in the Festival Hall on the Exposition grounds. By and large, the convention was most successful. Inspiration was not lacking, and a month from now reflection will show it to have been one of the most important ever held so far as lasting influence on the industry is concerned.

President Scott's Address

IN his address as president of the National Electric Light Association, Mr. H. H. Scott devoted much attention to future constructive work for the association membership. He would have the managers of central-station companies leaders in all matters concerning the welfare of their communities. Employees would be able to explain fundamental questions affecting the industry. The public would comprehend that it is buying a service, not a commodity. All that the association can do to promote public understanding of central-station problems will accomplish wholesome results. However, it is better that it should do well and thoroughly the things that it undertakes than that it should attempt too much and fail to be effective. The gravity of the problems of the times is appreciated by men in executive and in managerial capacities in all departments. To lead the great body of workers to have a profound sense of their ability to help the industry, to stimulate them to act in its protection when its best interests are jeopardized is a worthy task. This is one of the conclusions which Mr. Scott leaves to his successors to the end that efficiency and good service shall receive due tribute.

Triumph of Electric Illumination

EVERY visitor to the Panama-Pacific International Exposition, whether he be a layman or skilled in the electrical art, is impressed with the masterful illumination of its grounds and palaces. The lighting is the one dominating feature that stands out above all else connected with that exposition. Beautiful as are the palaces, grounds and lagoons by day, the view by night under artificial light is even more beautiful. In their addresses at the convention of the National Electric Light Association just closed in San Francisco, the Exposition officials were not remiss in acknowledging their debt to electrical engineering and to Mr. W. D'Arcy Ryan for his contribution. The central-station men gathered there must have listened with a large measure of pride, as well they might, to the fitting tribute accorded the industry with which they are connected.

The Debt Owed to the Electrical Industry

ALL of us are prone at times to insist on our rights and to forget our obligations. What is true of men in particular is true also of cities, states and nations. It was altogether fitting, therefore, that in its annual report the public policy committee of the National Electric Light Association should call this obligation to remembrance. The voicing of this sentiment was especially appropriate at San Francisco, for on the Pacific Coast, from border to border and from the mountains to the sea, every industry that makes for wealth, productivity and development depends on the electrical energy generated from the falling waters of the Sierras. The transmission and distribution of this energy over long distances is a monument to private

capital and to the electrical engineer. It is not a heritage of bygone days but the work of pioneers still living to whom has not been meted out a full measure of reward. However, the committee does not mean to suggest that the industry shall make the mistake of insisting boldly on its pound of flesh. The central station recognizes its obligation to the community and in most cases is willing to fulfill that obligation. It asks for itself from the general public merely the same measure of consideration.

Public Policy for the Public

In its comprehensiveness, interesting criticism and dignity, the public policy report presented before the National Electric Light Association convention this week is fully abreast of the high standards of previous years. Because it departs this year from its mission in the past and gives opinions on what the public may do to maintain a fair company policy, as well as on what companies may do to maintain a fair public policy, the report will receive more than the usual attention. Since its organization the committee has been in intimate contact with the great questions of public policy affecting the industry, and its tenth report carries the conviction that it represents the determined association point of view.

The industry does believe most earnestly that it takes two parties acting in sincere co-operation to perfect judgment on those larger issues of a public nature on which the welfare, progress and service of the community rest. It has a keen consciousness of the fact that mistakes have been made on both sides, that in the past companies have gone beyond the bounds of reason and that the public has done so too. If the companies had always maintained the wisest policies and the public representatives had always sought conscientiously to be fair to the property interests concerned, the matters remaining unsettled between these two elements of seller and buyer would be simplified greatly. The question, however, is not what might have altered the events that developed inevitably from unnatural conditions of the past; the question is where the industry and the public stand now. The industry generally is under regulation. Whether some companies submitted unwillingly at first, whether they accepted slowly, is not so critical a matter at this time, when the central stations of the country are very largely under regulation and are trying to live under it, to make it workable, and to show the commissions what reasonable policies will promote success.

That successful, prosperous companies must exist under regulation if regulation is to be a permanent factor in this country is undeniable, because no other than successful, prosperous properties can provide at economical cost the service that the public is entitled to have or raise the capital to furnish the constant extensions of facilities for which every hustling, growing community loudly cries. In order for these desirable conditions to prevail it is necessary for the public to search its acts and follow with determination reasonable policies designed deliberately to bring them about. Looking to this end, the logical climax of the report of the public policy committee is a manly plea for fair public understanding and treatment of the companies. Characteristically the committee suggests that member companies urge public recognition, not of their rights, but of their just claims for support. It is in a spirit of undoubted and undisguised pride of attainment and power that the committee writes. Confident in its statement that no other single industry has contributed more to public comfort, convenience and welfare, the committee asks for the companies a reward reasonably proportionate to the value of the service rendered. It does not ask in detail for a specified collection of apologies, atonements or reparations. It does say that strength and efficiency in the utility are assets to the community, that public good-will and co-operation are merited, and that what is most needed is public appreciation of the actual facts. The industry will look with assurance to the committee to continue to develop acceptable principles upon which companies and public may go forward.

The West and the East

It has been the habitual inclination of the Eastern central-station man to overlook the guidance and the inspiration that the situation in the Far West offers him. Any degree of personal touch is difficult to establish and maintain. Physical conditions are clearly not the same, and the Easterner has been wont to say, "My problems are my own; his case is different." But conditions in the cities of the Far West typify very largely what the coming years will bring to Eastern cities. Therefore, the commercial practices of the Western central station and the phases of its market should be studied with deep interest.

Western cities such as Portland, Seattle and Los Angeles have been built since the coming of the "electric era," while the cities in the Eastern States were built before the electric era. In Seattle, for instance, it is safe to say that in 80 per cent of all existing buildings, including old, small residences, use is made of electric service, and this figure will apply approximately to all Far Western cities of 5000 inhabitants and over. In smaller cities and towns the percentage of houses wired is said to be still higher, probably nearly 90 per cent. In many small communities every building of the town is connected to the central-station circuits. The result is a very high state of electrical development in residences and a very advanced market for all types of domestic energy-consuming appliances. In short, the merchandising problem has practically reached the point which will confront the Eastern central stations several years hence, when the sale of lamp-socket devices to their customers begins to approach the numerical saturation point.

To a considerable extent the central stations on the Pacific Coast are at present solving many of the service and commercial problems which the industry in the

East will face in the years ahead, and from a salesman's standpoint they set a stimulating example that should not be left unpondered.

A 200-Mile Artificial Transmission Line

An interesting article by Messrs. Magnusson, Goodeerham and Rader appears in this number upon a recently constructed artificial line, of adjustable constants, for use in a research and instruction laboratory. This line has the advantage that the sections are small, each corresponding to only 10 miles of actual transmission line; so that the hyperbolic angle subtended by each is relatively small at all frequencies, even within the commercial telephonic range, and the lumpiness error correspondingly minute. Another advantage is that the resistance, inductance and capacitance of each section can be adjustably varied over a certain range, so as to change correspondingly the physical conditions of the imitated line over a very considerable range.

Such an artificial line has great advantages in a technical college laboratory. In fact, considering the moderate cost at which an artificial line can be constructed, it seems probable that all the leading electrical engineering colleges will provide themselves with one before very long. The insight which a student secures into the electrical working conditions of a long line by actual experiment is far more searching and pervasive than that which he can ordinarily obtain by reference to books and arithmetic. In this respect a model line is as satisfying as the model citizen, defined by the schoolboy as a "small-sized imitation of the real thing."

In wire telephony artificial lines have been used in various experimental tests for a number of years. They are naturally less bulky than artificial transmission lines, since they need much less line conductance. Moreover, with some artificial telephone lines one is content to employ highly laminated iron-core coils for their line inductances, thus still further reducing the bulk. Hitherto, in artificial transmission lines like that of Professor Magnusson here considered, the use of ferric inductances has been avoided in order to eliminate the complexities of hysteretic loss in the line. However, it may yet be possible to design artificial transmission-line sections with iron-cored coils. At all events, artificial transmission lines, as described in the article, are now so satisfactory in their behavior for laboratory purposes that future improvements are likely to be directed toward compacting, adjusting and manipulating them.

Experience in the classroom seems to indicate that the best and simplest way of leading the student in his study of artificial alternating-current lines is to let him commence with a thorough investigation of direct-current lines containing only lumps of line resistance and line leakance. A storage battery can be applied at the generating end of such a line and any desired resistance load at the motor end. By means of an ordinary direct-current potentiometer the student can then measure the distribution of unidirectional voltage, current and power along the line, section by section and leak by leak, with a very satisfactory degree of precision. After he has checked his observed distributions against the corresponding computed distributions, so as to fix the application of the controlling direct-current formulas clearly in his mind, he can then proceed to apply the same formulas, interpreted with complex numbers, to the use of the alternating-current artificial line. In this manner practically each of the formulas he needs to use can be written within the area limits of a thumbnail.

Development of the Montana Power System

One of the most important systems east of California is that of the Montana Power Company. Moreover, it is one of the very early systems, the first plant having gone into service in 1897 at the modest pressure of 15,000 volts. Five years later the next important addition to the generating system was operated at 50,000 volts. Two years afterward the pressure at the same plant was raised to 70,000 volts, and five years ago the standard transmission emf of 102,000 volts was adopted for the big Rainbow plant of the same system.

At the present time the company has in operation sixteen plants having an aggregate rating of over 75,000 kw. Three more hydroelectric plants are shortly to be added to the system, bringing in an additional 120,000 kw in rating. These new plants will serve as a source for added power for the already large load on the system, and particularly for the operation of some 450 miles of railway, the electrified main line of the Chicago, Milwaukee & St. Paul, which crosses three mountains within the range of the Montana Power Company's operations.

Of the total length of close on to 1500 miles of transmission lines less than 350 miles is of steel-tower construction and the rest is about equally divided between pole lines with suspension insulators and those with pin insulators. The suspension type is standard for everything above 45,000 volts. However, on the 70,000-volt circuits use is made of a good many glass insulators on treated wooden pins which have shown surprisingly good results. This is one of the few high-pressure lines on which glass insulators are used to any considerable extent. Incidentally it is worth noting that the operation of the Montana Power Company system has been of the very best. We doubt if any transmission system in the country has shown on the whole a better record with respect to continuity of service.

It is interesting to observe that the original turbines and generators of 1897 are still doing good service, and in fact the early generators were of such stalwart design that they can be treated in a way that would scarcely be wise with some of their successors. The load, which is largely derived from the great Montana mining interests, has been steadily growing all through the years of service, and with the coming of the railway load the system will not only be one of the most heavily loaded in the country but will be unique in the extent and importance of its traction work.

San Francisco Convention of the N. E. L. A.

Encouraged and Confident for the Future, the Members Report Financial, Commercial and Technical Progress—Telegraphic Report— E. W. Lloyd Elected President

THE thirty-eighth convention of the National Electric Light Association, which was held in San Francisco this week, closed yesterday after a successful meeting with the election of Mr. E. W. Lloyd of the Commonwealth Edison Company of Chicago as president. From the lighting of the Temple of Light and Flowers erected around the Dewey monument in Union Square on Monday night to the closing session on Friday morning, the days and nights were filled with work and entertainment. A brilliant reception held by President H. H. Scott in the ballroom of the St. Francis Hotel on Monday night was attended by men and women of prominence in business and social circles of San Francisco and by the leaders of the electrical industry attending the convention.

Activities reached their height in the celebration of N. E. L. A. Day at the Panama-Pacific International Exposition on Thursday afternoon, followed in the evening by the public-policy session. Bearing in mind the part played by electricity in the exquisite illumination of the Exposition, every honor was paid to the delegates during the week. The Brooklyn Company Section had the honor of carrying off the Doherty Medal and the Harriet Billings award. To Mr. William D. Katenberger was awarded the Doherty Medal for his paper on "Advanced Methods of Obtaining Big Power Business," and Mr. A. G. Paulsen won the Harriet Billings award of $50 in gold for his paper on "Conditions Affecting the Continuity of Central-Station Service." Chairman Paul Lüpke announced the committee selections.

E. W. LLOYD, PRESIDENT-ELECT OF THE N. E. L. A.

"Welcome to the Pacific Coast"

Tuesday morning's session was opened with an address of welcome by the Mayor of San Francisco, Hon. John Rolph, Jr., who told of the wonders performed by electricity in San Francisco, and paid a tribute to Mr. John A. Britton, vice-president and general manager of the Pacific Gas & Electric Company, as one of the great leaders in the electrical industry. The Mayor dwelt on the loyalty and devotion of the organization of the above company as exemplified on the day set apart by Exposition officials as Pacific Electric Day, and he also outlined the features of the Exposition. Seeing Mr. W. D'Arcy Ryan in the audience, Mayor Rolph spoke of the very important work performed by him in lighting the Exposition.

In a stirring address Mr. John A. Britton, vice-president and general manager of the Pacific Gas & Electric Company, welcomed the association to the coast. He rehearsed the history of the Pacific Coast States during the pioneer days and the hardships under which the pioneers labored.

Mr. Britton stated that the ditches first built to carry water for mining purposes now carry water to drive the generators that create the electrical energy to uncover the gold of the field, to make three blades grow where one grew before, to turn the wheels of countless factories, to illuminate the highways and byways, and to light the homes and lessen the burdens of mankind, so that the race may be better, stronger and nobler. He spoke of the lighting industry as a child in years but a giant in strength, and invited the delegates to witness how the men of the West had used electric science. He stated that they have done those things which were new and untried and with that same intensity of purpose and certainty of realization have blazed the trail, choosing, with the hardihood and fortitude that marked Western pioneers, new and untracked paths which lead to victory.

President Scott's Address

President Scott said that it was peculiarly fitting that the thirty-eighth convention should be held in the city of San Francisco, whose people are celebrating the completion of one of the greatest engineering feats of all times. Of the future he said:

"One of the problems that confronts us all the time is that the public does not comprehend that we are selling a service, not a commodity, or kilowatt - hours. Neither does it know that while everything else is going up in price and we are paying more for our raw materials and labor, we are giving the public approximately six times as much light for $1 as we did fifteen years ago. The public is receiving all the benefits of the wonderful increased efficiencies of the incandescent lamps and at the same time, in many localities, is requesting a reduction in the rates per kilowatt-hour. It brings home forcibly to us that the sale of energy on a straight kilowatt-hour rate is not equitable, but that in addition to a rate for energy we should have a demand charge and a fixed charge per customer. I asked Mr. Thomas A. Edison a short time ago how he first determined how to charge for electric energy, and he wrote the answer in his own hand as follows:

How Edison Sold Service in Early Days

" 'I sold light, never current. All lamps were 16-cp, and a lamp was called the equivalent of a gas burner supplied with 5 cu. ft. of gas. Our charges were based on gas at $2 per 1000 cu. ft., which was then the prevailing price.

" 'The reason I wanted to sell light instead of current was that the public did not understand anything about electric terms or electricity and had no confidence they ever could learn; but they did understand light, and it was light they paid for and we could make explanations they could comprehend.

"'Another reason why I did not want to sell current was that from my experiments I knew that the incandescent lamp was only the beginning, and that there were great possibilities of enormously increasing its economy, and I thought that the pioneers should reap some reward for these improvements. It was my idea that of all the benefits which improvements in the lamps should attain, one-half should be given the public and one-half given the company. But, for some reason, after a few years the selling of current was introduced, thus destroying all chance of the companies' gaining any benefits from improvements; in fact, such improvements were a disadvantage, which to my mind is a poor business policy for the company and the public.'

"Mr. Edison is right when he says that the companies should receive at least half of the benefits arising from improvements made in appliances.

Problem of Raising Capital

"It is true that the central-station business, on the whole, has continued to show gross increases during the period of the introduction of the high-efficiency lamps, and also during the trying times we are passing through, because other lighting business and additional motor-service and industrial load have more than offset the losses due to the changes. But the tendency of the times is making it hard for public utility companies to raise capital, and if this continues it will retard the wonderful possibilities in the growth of the electrical business, and the public will suffer.

"For instance, if our regulating bodies will not allow a return sufficient to attract capital, fewer extensions to residential customers will be made and the extensions to the rural districts will be postponed. It is a fact that the public is more interested in the ability of public utility companies to keep pace with the growth of the communities and to render good service than in the rate for the service. I am not a pessimist, for we know the men in our industry have solved many big problems in times past and they are capable of convincing the public ultimately that capital and brains should be rewarded liberally."

Opportunities for Increased Membership

In his report as chairman of the committee on organization of the industry, Mr. George Williams recommended that the work of securing new members be carried on by state sub-committees, as has been done during the past year. Attention was called to the fact that there are more than 20,000 electrical men who are desirable and eligible for N. E. L. A. membership.

Although there have been losses in membership of nearly all other industrial and technical associations, the N. E. L. A. has gained, the membership at present and the increases during the year being as follows: Class A, 1125 members, increase 34; Class B, 11,125 members, increase 308; Class C, 96 members, increase 23; Class D, 253 members, increase 3; Class E, 808 members, increase 23; foreign, 41 members; total membership, 13,448; increase, 431.

Report of the Secretary

Secretary T. C. Martin described the large volume of business conducted in the headquarters office. During the year 150,000 copies of the association *Bulletin* were issued, an average of over 13,000 for the eleven months of publication. The effort has been maintained to build

SAN FRANCISCO'S WELCOME TO THE N. E. L. A.—COLONNADE ERECTED BY LOCAL ELECTRIC COMPANIES SURROUNDING DEWEY MONUMENT IN FRONT OF HOTEL ST. FRANCIS

this up into a publication of magazine character without encroaching upon the legitimate field of the technical magazines. The activities of the vigorous and aggressive Commercial Section have been expanded greatly, and it has now taken over the publication of *Rate Research*, and has also taken a further most important step in the creation and organization of its educational course. The organization of the Accounting Section marks the apparent increasing tendency in the association to differentiate into group work, which may lead in time to the reconstruction of the old hydroelectric section or its merger into a broad technical section. The immense amount of work done by the lecture bureau, Mr. Martin said, is scarcely realized even by those who are in direct contact with it. The bureau has a working list of thirty-five lectures, most of which are illustrated. During 1914 the lectures were sent out over 130 times and were delivered before 40,000 members and their friends in twenty-five states and fifty-five cities. The lectures have been furnished on request to a number of educational institutions. The association has on file rate information from practically all member companies. It has sought to develop and maintain friendly interchange relations with all the public service commissions, furnishing them with its literature and data and receiving in return copies of rulings, decisions and annual reports as well as prompt information as to decisions.

Report of Insurance Expert

One of the matters of prime importance to which attention has been given during the last year by Mr. W. H. Blood, Jr., insurance expert for the association, has been the suits brought against member companies at the instigation of fire-insurance companies. In the case of electrical fires of indefinite origin there has been a tendency to attempt to fix the blame upon the central-station company. A suit of this kind of unusual importance was that of the Milton Weaving Company against the Northumberland County Gas & Electric Company. The amount involved was about $80,000. The outcome was successful in the lower court, and an appeal was heard by the Supreme Court on May 10.

Attention is called to the general tendency, as indicated by suggested changes in the rules, to install properly grounded circuits. Following this general suggestion is the idea that the grounded side of the circuit should be a solid line; in other words, that all fuses and switches on the permanently grounded side of the line should be eliminated. This rule undoubtedly will eventually carry with it the elimination of insulating joints. It emphasizes the necessity of securing reliable ground connections.

It is suggested that member companies in whose district renewable fuses are used keep a close watch on their operation, so that it may be possible to determine whether by the use of fuses refilled on the premises accidents or fires are increased or decreased. It is the belief of the insurance expert that in the consideration of refillable fuses by users there has been a tendency to give too great weight to the cheapness of renewals as against the hazard involved.

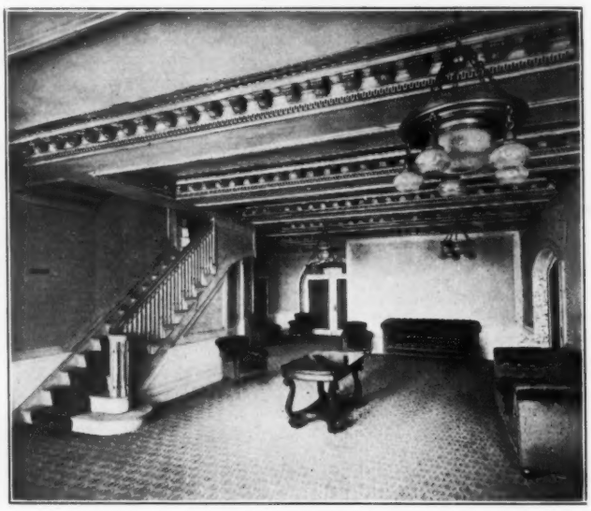
Report of Committee on Progress

The annual report on the progress of the electrical industry was presented by Mr. T. C. Martin. Besides the customary chronicle of advances made in the many different branches of the industry in both Europe and the United States, particular attention was drawn to the conditions caused by the European war. Among a multitude of other interesting statistics, data were given on the number of wired houses in this country, based on the results of a canvass made by the association. Returns from 100 cities having 5000 inhabitants and under, taken at random from all parts of the country, indicate that 58 per cent of the houses are wired. In cities having a population between 5000 and 10,000 the proportion wired was 54 per cent, and in cities having between 10,000 and 20,000 the proportion was 60 per cent. On the Pacific Coast the ratio ran as high as 98 per cent, while in the Middle West the average was over 60 per cent. The Atlantic Coast showed the lowest percentage. Since these figures represent conditions in the more progressive communities, the totals would probably be lower if complete returns were available. The returns for the Middle West and the Pacific Coast probably represent local conditions accurately, but, it was observed, they seem entirely inapplicable to the East.

The Association "Question Box"

In his report on the "Question Box," Mr. S. A. Sewall said that during the year 1500 questions and answers were published. He asked for the hearty co-operation of the entire membership in making that branch of the *Bulletin* more useful to the industry.

The committee on question-box revision reported that



REGISTRATION HEADQUARTERS IN CONVENTION BUILDING

no attempt has been made to revise material in the question box, as it is doubtful that the information contained therein is of sufficient permanent value to warrant spending the time and money necessary to codify and condense it into one volume. The answers represent different companies' individual practices, which may, however, be far from standard, and in some cases even undesirable and open to objection. It was suggested that it might be possible to re-sort, re-correct and re-edit the questions and answers so that they can be used in an operator's loose-leaf handbook.

Three sessions, the technical, the commercial and the accounting, were held on Tuesday afternoon.

During the first technical session a discussion of the report of the committee on electrical apparatus brought out some differences of opinion on the uniform rules for motors. The most important feature of the discussion was the adoption of a resolution, given elsewhere in full, providing for a special committee to study high-tension insulator problems, with sub-committees in various parts of the country.

Mr. Ryan on the Lighting of the Exposition

The session was concluded by an illustrated address on the features of the Panama-Pacific Exposition lighting, delivered by Mr. W. D'A. Ryan. After a brief description of the work of developing the original features of the lighting system and an explanation of the

technical problems and difficulties involved, a series of colored slides was projected on the screen portraying in a very striking manner the beautiful color effects which Mr. Ryan devised and applied. The slides were as nearly perfect as reproductions could be, and Mr. Ryan presented clearly the points of technical interest. To all present it was evident that in producing the softened tones, in developing the delicate color effects, and in eliminating the disadvantages of the old methods, Mr. Ryan is to be credited with creating that which will have a strong and lasting influence on the art of illumination.

The principal topics discussed during the Tuesday afternoon commercial session were those of campaign literature for the wiring of residences and the education of salesmen and other employees.

Address of Chairman Burnett

In his address as chairman of the Commercial Section, Mr. Douglass Burnett reviewed the work of the section's committees for the year, commenting in particular on the efforts of the committee on the wiring of existing buildings looking toward the standardization of plugs and receptacles, and on the results achieved by the publications committee in preparing, publishing and distributing nearly 1,000,000 pieces of printed matter to date. Chairman Burnett recommended continuance of the work of the committee along present lines.

Commenting on the friendly relations existing between the N. E. L. A. Commercial Section and other societies, Mr. Burnett reported the active co-operation of the industrial power committee of the American Institute of Electrical Engineers with the power sales bureau of the N. E. L. A. in the preparation of motor-application data in standard form. A friendly spirit of co-operation has also been manifested by the National Commercial Gas Association.

In reporting on the financial standing of the Commercial Section, Chairman J. F. Becker of the finance committee showed a balance of nearly $3,000 in the section treasury, compared with a credit balance of $600 last year. The total income for the year came to $16,500, while the revenue from the sale of publications alone amounted to $12,100.

Commercial Section Membership Now 2500

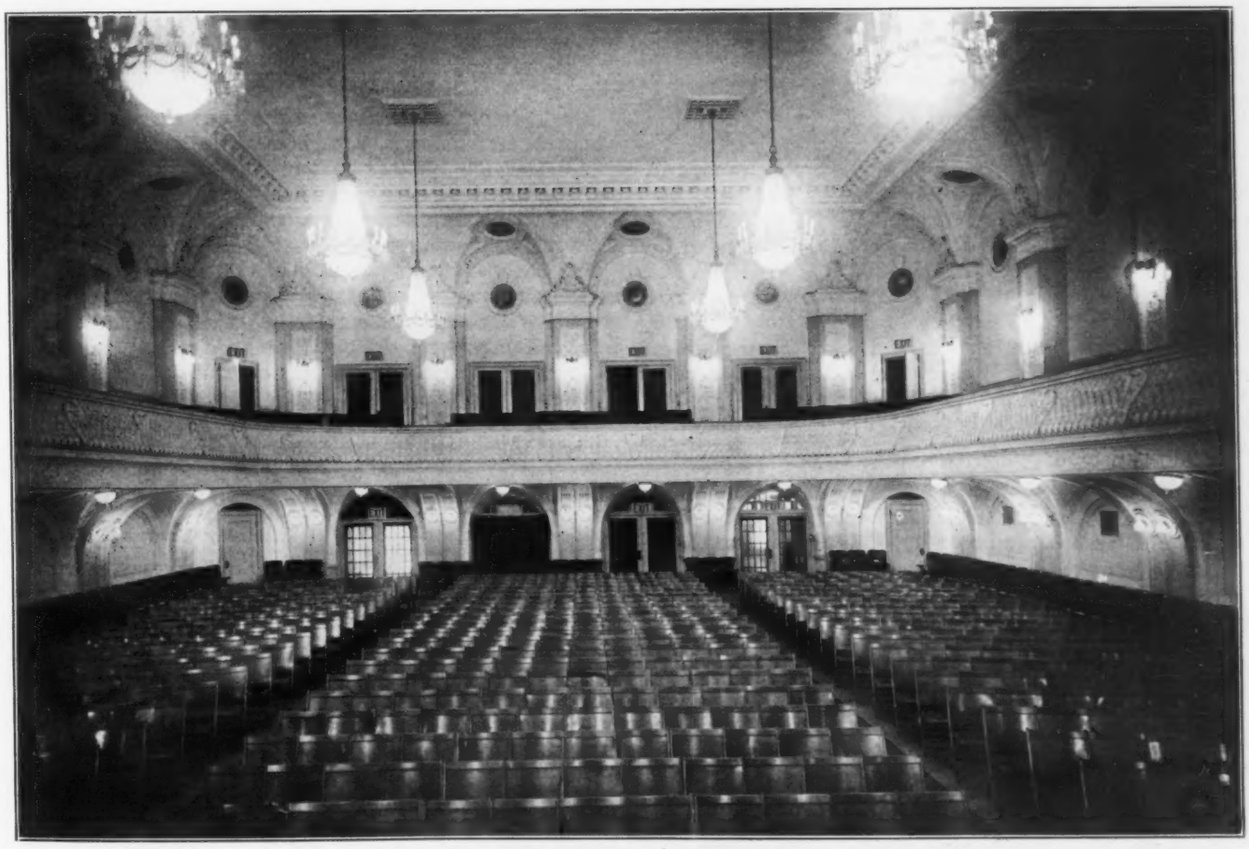
Adopting as its slogan "The more members the more value to each member," the committee on membership, of which Mr. John G. Learned is chairman, reported a present section membership of 2542, indicating a net gain of nearly 1000 since the committee took charge of the work. In the first four months of this year 1085 new members were added to the section enrolment. The waiving of the former $2.50 annual dues for the Commercial Section, beginning with the first of the present year, has been the means of bringing in many members who otherwise would not have affiliated with the section, said the chairman. The work of the membership committee has been conducted without expense to the association, and every effort has been made to acquire memberships from the ranks of active commercial men.

At the first accounting session the topics discussed related almost entirely to the treatment of sinking-fund payments and to the distribution of overhead-expense items among departments of utilities operating both electrical and gas services.

Address of Chairman Edwards

In his address as chairman of the Accounting Session, Mr. H. M. Edwards dealt with the change in the conditions under which the section will be conducted.

If a company is to develop its territory properly and effectively, it must attract new capital freely to the enterprise, and to do so it must be able to obtain for its



HALL OF NATIVE SONS OF THE GOLDEN WEST BUILDING, IN WHICH CONVENTION SESSIONS WERE HELD

service rates which will enable it to meet its obligations and will provide adequate compensation for the invested capital. In the determination of the questions which arise when these two fundamentally important matters are being considered, the accounts are necessarily relied upon to furnish the correct answers.

The accountant can no longer conduct his business in the closet; instead, he is now brought into the full light of day and his records are subjected to keen and not always sympathetic scrutiny. It is not sufficient that his accounts be kept correctly; he must in addition be able to explain their significance and to establish their relevance and bearing upon the point at issue.

President C. C. Moore Addresses Commercial Session

At the second commercial session, held on Wednesday morning, President C. C. Moore of the Panama-Pacific International Exposition addressed the convention. He said that of the 850 conventions that had chosen San Francisco as their meeting place for 1915 the electrical men were especially welcome, since the greatest advance marked by this exposition is its electric illumination. This, he said, should be a matter of pride to electrical men. He called attention to the great hydroelectric developments on the Pacific Coast and paid a tribute to Mr. John A. Britton as the general manager of the greatest system of its kind in the country and also to the work of Mr. Britton in connection with the Exposition. He also made acknowledgment of the work of Mr. W. D'Arcy Ryan.

The principal topics discussed at the session were the sale of energy and the sale of appliances. The report of the power sales committee was illustrated by a number of lantern slides which showed how electrical energy has been applied on the Pacific Coast for dredging, irrigation, mining and other purposes. The discussion on the sale of appliances revealed a sentiment against systematic cutting of prices, the belief that sales agents should be placed on a proper salary and even have a share in the increased gross earnings and a general feeling of optimism that the possibilities for the application of electrical energy are greater now than ever before.

Executive Session and Treasurer Wells' Report

At the executive session on Wednesday the report of Treasurer W. F. Wells of Brooklyn, N. Y., was read. It showed assets of $43,667 and liabilities of $9,420, leaving a surplus of $34,247. Of this $14,514 is invested in securities, leaving a net balance of $19,733. The income for 1914 was $136,327 and the expenses were $122,811 of the total income. Approximately $84,000 represented dues, $25,500 represented income from publications, and $27,000 represented income for convention expenses. The running expenses of the organization were approximately $93,000 and the convention expenses $29,000.

Gas-Filled Lamps and Concentric Wiring

During the third commercial session the report of the lamp committee was read by Mr. W. W. Freeman. Letters from Mr. Frank W. Smith, chairman of the committee, and Mr. John W. Lieb were listened to with keen attention by 150 delegates. The discussion developed into a good round-up of available experience with the gas-filled lamp and its characteristics as developed both in service and in laboratory tests. The saving in maintenance was dwelt upon by those who have used the lamp in New York City and Brooklyn. The blue-glass lamp was considered to be a novelty of limited usefulness.

The report of the committee on the wiring of existing buildings was also greatly appreciated. The discussion centered on concentric wiring, which Eastern delegates believe will enable them to take care of installations in small buildings without burdening the companies. It was pointed out that the larger ratio of small houses which are wired in the West as compared with the East is due to the fact that the Western houses are usually newer and were wired when built. However, the Western men showed a keen interest in the subject. Mr. H. R. Sargent of the General Electric Company stated that his company is now making tools and dies for fittings and that fittings will be available for trial installations in about three months.

After the reading of papers presented at the second hydroelectric and third technical sessions, the chairman turned the meeting over to Past-president W. C. L. Eglin. Those who expressed views on the special provisions for safeguarding transmission lines over crossings were unanimously of the opinion that the present requirements weakened rather than strengthened the construction in the matter of inductive interference. Numerous citations were made to show that much more must be learned as to causes before there can be assurance as to the removal of the difficulty in the various cases that arise. Special interest attached to the mention of an instrument now being developed by an Eastern telephone company for locating the point where interference occurs.

Meeting of Class D Members

At a meeting of Class D members on Wednesday Messrs. J. F. Gilchrist, F. H. Gale and S. E. Doane were re-elected to succeed themselves. The election of a chairman will take place at a later meeting.

The exhibition committee comprises the following members: Messrs. H. G. McConnaughy, secretary and treasurer; C. Blizard, S. E. Doane, F. H. Gale, J. F. Gilchrist, J. C. McQuiston, John Mustard, J. W. Perry, C. L. Price, Jr., J. I. Ayer, chairman.

Lively Discussion on Rate Topics

The fourth commercial session, held on Thursday, was marked by lively discussions on rate topics, following the reading of the report of the rate research committee.

The opinion was expressed that central stations are justified in making a rate below the general average cost of service to those customers who operate at high load-factors during off-peak hours. In one case it was said that a manufacturer had been induced to change his working hours.

For the benefit of the public, the regulatory bodies, and the company itself, it is desirable that the cost of supplying each class of service be definitely known. The point was also brought out that no changes should be made in rates until after a very careful investigation.

After the presentation of the above papers and reports, Messrs. S. V. Walton, San Francisco, R. H. Knowlton, Philadelphia, and F. T. Snyder, Chicago, were appointed a committee to consider the future work of the power sales bureau.

Accident Prevention Subject at Thursday Technical Session

At the fourth technical session on Thursday morning practically all discussion was on the subject of accident prevention. Speakers from various parts of the country expressed the opinion that the work of accident prevention was primarily a campaign of education. Workmen are invariably more careless of their safety than of their positions, it was declared.

The greatest success in accident prevention work has been attained, it developed, when the campaign has been so planned as to enlist the co-operation of employees rather than merely to instruct and warn them. It was agreed that good returns would practically always be realized on a judicious outlay for instructing employees

and the public in safety-first principles and in making sure that equipment is always in perfect condition.

Accounting Section Organized, H. M. Edwards, Chairman

At the last accounting session, held Thursday, the report of the committee on cost accounting and the papers on "Analytical Accounting for Central-Station Purposes," by Mr. O. B. Coldwell, Portland, Ore., and on "Statistical Machines," by Mr. W. E. Freeman, Brooklyn, N. Y., were read.

The new constitution of the Accounting Section was next read and adopted, and the following officers were

HENRY M. EDWARDS, CHAIRMAN-ELECT ACCOUNTING SECTION

elected: Chairman, Mr. H. M. Edwards, New York; vice-chairman, Mr. J. L. Bailey, Baltimore, Md.; secretary, Mr. E. J. Allegaert, Newark, N. J.; treasurer, Mr. C. E. Calder, Dallas, Tex.; executive committee, Messrs. R. H. Ballard of Los Angeles, J. S. Gould of Smiths Falls, Ont., J. H. Gulick of Chicago, R. W. Symes of Detroit, L. M. Wallace of Boston, Paul R. Jones of New York, and Dexter of Seattle.

Mr. Henry M. Edwards, chairman of the new Accounting Section of the N. E. L. A., is auditor of the New York Edison Company. He has held that position since the company was formed in 1901 as a merger of a number of other properties. Mr. Edwards was born in New York fifty-five years ago and received his early education at the city schools, later enrolling at the College of the City of New York. Previous to his connection with the New York Edison Company he was auditor for the Manhattan Electric Lighting Company and affiliated companies. His entire business career has been spent in the electric central-station business. He was largely instrumental in bringing to the attention of the N. E. L. A. the necessity of giving more prominence and attaching more importance to the accounting activities, which formerly were absorbed in other sessions. In recognition of his endeavors and of his standing as an accountant, he was made chairman of the accounting committee. He has been an active factor in the preparation of the association system of accounting. In 1914 he wrote a book entitled "Electric Lighting Accounts." This was written at the solicitation of many friends in the industry who sought his views as an authority on central-station accounting.

N. E. L. A. Day at the Exposition

Thursday afternoon was set aside by the Exposition officials as N. E. L. A. Day at the fair, and the delegates went out to the Exposition grounds as a body in buses, were photographed in a group, and marched in column-of-six formation to Festival Hall. Here they were addressed by Mr. John A. Britton, vice-president of the Pacific Gas & Electric Company, chairman of the day, and the personal representative of Governor Johnson of California. President Charles C. Moore of the Exposition followed Mr. Britton and presented to President Scott of the N. E. L. A. a bronze medal commemorative of the convention.

The chairman then introduced Mr. W. D'Arcy Ryan, who expressed his personal appreciation of the praise and favorable criticism that had been accorded to the illumination features of the Exposition. He concluded by calling for three cheers for Mr. Guy L. Bailey, chief electrical and mechanical engineer, which were given with a will, with the audience standing.

Mr. Insull on Electric Lighting Development

Mr. Samuel Insull, president of the Commonwealth Edison Company of Chicago, followed with an address on "The Origin, Development and Effect of Lighting by Electricity." He drew attention by specific references to the manner in which the great expositions of the world have been milestones of electrical progress. To-day the N. E. L. A. represents an industry with annual gross income above $350,000,000 earned by central stations having a total rating above 8,250,000 hp, one-third of the output being supplied by water-power. In 1914 there were 110,000,000 lamps manufactured in the United States out of a world production of 250,000,000. The first incandescent lamps put in use, commented Mr. Insull, consumed six times the energy used by the ordinary commercial lamps of to-day. It is desirable and economical to concentrate the production of energy, whether from water-power or steam, in generating stations of 100,000 hp to 300,000 hp. The distribution area served by each such stations varies with the density of population and intensity of demand.

JOSEPH F. BECKER, CHAIRMAN-ELECT COMMERCIAL SECTION

The Pacific Gas & Electric Company, which, as a part of its every-day business, supplies the energy for the Exposition, affords an example of the benefit to a community where large capital is employed in the development of the plant. The company serves an area—extending from the summit of the Sierras to the Golden Gate—as great as that of Denmark, Holland and Belgium, with a population of 1,750,000, which is greater than that of Rhode Island and Connecticut combined.

Of a total power consumption in the United States estimated at 150,000,000 hp, averaging about 1.5 hp per

capita, the small proportion consumed in the form of electrical energy shows the possibility for growth of the electrical industry. Mr. Insull quoted the estimate of Mr. Frank A. Vanderlip that upward of $400,000,000 a year new capital will be required for several years for the proper development of the electrical industry.

Relative to the important problem of coal conservation, upward of 500,000,000 tons of coal is consumed annually in the United States for all purposes; of this only 5 to 6 per cent is used for producing electricity, but eventually one-half to two-thirds will be so used, predicted the speaker. The development of a possible 200,000,000 hp in the hydroelectric plants would greatly conserve the coal supply, so that it is probable that the annual coal consumption would be reduced one-half, judging from the lack of efficiency of the ordinary steam plant. Only by concentration of production and distribution can low cost to the producer, and hence to the consumer, be obtained. The highest economy is secured by disregarding artificial boundaries such as those of municipalities and states. In Europe the restrictions incidental to such boundaries have interfered with the natural and economical development of the business, while its growth in this country has been helped by the comparative lack of such restrictions.

Electrical development is revolutionizing modern conditions. The effect of central-station and electric-railway development is to spread urban population over wider areas, and these two electrical industries have brought the rural sections better transportation and cheaper energy for manufacture, thus enabling workers to establish themselves where they can bring up their families with the advantages of open-air living in healthful locations.

Telegrams from the Absent

The exercises closed with the reading by Secretary T. C. Martin of messages of greeting and congratulation from notable men of the industry who were unable to be present, including Messrs. Thomas A. Edison, Alexander Graham Bell, Elihu Thomson, Newcomb Carlton, Clarence Mackay, Frank J. Sprague, Charles P. Steinmetz, Charles F. Brush, D. R. Street, C. A. Coffin and John J. Carty.

Mr. Carty's message was of special interest because it had been telegraphed over the transcontinental telephone line while the circuit was at the same time being used for telephone conversation, utilizing energy supplied by the central-station companies of New York, Pittsburgh, Chicago, Omaha, Denver, Salt Lake City and San Francisco, all members of the N. E. L. A.

Mr. Carty mentioned as evidence of the success of the association the fact that its member companies supply the energy required to operate 25,000,000 miles of telephone wire extending everywhere throughout the United States and serving as the means of transmitting 15,000,000,000 telephone messages annually. Nothing could better show the interdependence of the signaling circuits and the electric light and power circuits, or more clearly emphasize the necessity for cordial co-operation. As incoming president of the A. I. E. E., Mr. Carty pledged himself to promote co-operation between electric light and power engineers and those in other branches.

Utility Regulation Theme of Public Policy Meeting

The public policy meeting held Thursday night was as usual the most important session of the convention. The report of the committee was read by its chairman, Mr. W. W. Freeman of Cincinnati, and addresses on public-utility regulation were made by the Hon. Max Thelen, president of the Railroad Commission of California, and by Mr. John H. Roemer, ex-member of the Wisconsin Railroad Commission. These are printed elsewhere.

The Glee Club of the Pacific Gas & Electric Company rendered several musical selections during the evening.

Commercial Section Elects Joseph F. Becker Chairman

At the fifth commercial session, held on Friday morning, a paper on motor-service sales methods was presented, after which the following officers were elected: Chairman, Mr. J. F. Becker, United Electric Light & Power Company, New York City; vice-chairman, Mr. E. A. Edkins, Commonwealth Edison Company, Chicago; vice-chairman, Mr. C. J. Russell, Philadelphia Electric Company, and secretary, Mr. C. A. Littlefield, New York Edison Company. Messrs. N. H. Boynton, Cleveland, Ohio; J C. McQuiston, East Pittsburgh, Pa., and W. R. Collier, Atlanta, Ga., were re-elected members of the executive committee and the new members added were Mr. E. W. Rockafellow, Western Electric Company, New York, and Mr. C. J. Russell, Philadelphia Electric Company.

Members of the Commercial Section expressed themselves especially appreciative of the work done by the retiring chairman, Mr. Douglass Burnett of Baltimore, Md., who filled out the unexpired term caused by the resignation of Mr. E. L. Callahan.

Mr. Joseph F. Becker, chairman-elect of the Commercial Section, has been general sales manager of the United Electric Light & Power Company, New York City, for about seven years. During the nineteen years prior to 1909 he was connected with the Edison Electric Illuminating Company of Brooklyn, first as meter clerk, then as superintendent of the meter department, and finally as general sales agent. The fact that the business of the United company increased 33 per cent in 1914 as compared with 12 per cent the previous year has been cited as an indication of Mr. Becker's executive and commercial ability. He has been active in many organizations. He was chairman of the membership and finance committees of the N. E. L. A., has served on the education, publicity and residence-lighting committees, and during last year was first vice-chairman of the Commercial Section. While chairman of the membership committee of the Electric Vehicle Association of America Mr. Becker approximately doubled the number of members. He was statesman of the Jovian Order in 1913 and chairman of the New York Company Section of the N. E. L. A. in 1912. Mr. Becker is also a member of the New York Electrical Society and the Illuminating Engineering Society.

Final General and Executive Session

The final general and executive session was held on Friday morning. Reports were read on company-section work, and Messrs. J. F. Gilchrist and A. J. Marshall presented the major phases of electric-vehicle development as related to the central station.

Mr. J. M. Wakeman, general manager of the Society for Electrical Development, Inc., delivered an address on "Electrical Prosperity Week."

Amendments were made to the constitution providing for the formation of a Manufacturers' Section, to which all Class D and Class E members are eligible. The executive committee of the association will consist of the usual officers and nine members elected from Class A and Class B, together with the president or chairman of the Manufacturers' Section and two members of that section.

All of the Pacific Coast members of the association met earlier in the week and, after discussing at some length the situations confronting them and their relation with the national body, decided to ask for better representation in the executive committees of the organization. The feeling was freely voiced among

them that the Pacific Coast should be represented on the board by a vice-president, a member of the executive committee and a member of the public policy committee. It was also decided that some one of these should attend the meetings in New York, and that a geographical section embracing the Pacific Coast States should be formed, in theory if not in fact, at which electrical problems before the industry on the Coast could be discussed. The wishes of the Pacific Coast members were made known to the officers and the nominating committee of the association and considered by them.

At the suggestion of the nominating committee, which was headed by Mr. Samuel Insull, the following officers were elected: Mr. E. W. Lloyd, Commonwealth Edison Company, Chicago, president; Mr. H. A. Wagner, Consolidated Gas, Electric Light & Power Company, Baltimore, first vice-president; Mr. W. F. Wells, Edison Electric Illuminating Company of Brooklyn, second vice-president; Mr. R. H. Ballard, Southern California Edison Company, Los Angeles, third vice-president; Mr. R. S. Orr, Duquesne Light Company, Pittsburgh, fourth vice-president; Mr. W. H. Atkins, Boston Edison Company, treasurer; Mr. W. H. Blood, Jr., Stone & Webster, Boston, insurance expert; Mr. T. C. Martin, secretary; Miss Harriet Billings, assistant secretary and treasurer.

The following were elected members of the executive committee: Messrs. J. E. Davidson, Portland, Ore.; H. C. Abell, New York; H. C. Bradlee, Boston, and R. F. Pack, Minneapolis.

President-Elect Lloyd

Mr. E. W. Lloyd, president-elect of the National Electric Light Association, is the general contract agent of the Commonwealth Edison Company of Chicago. Mr. Lloyd was born at Belleville, Ont., Can., on Feb. 1, 1872. He received his early schooling at Belleville, his family later moving to Erie, Pa., where Mr. Lloyd was graduated from the local high school in 1890. After working as a draftsman in the steel mills in Pittsburgh for two years, Mr. Lloyd accepted a similar position with the Crane Company at Chicago. In June, 1893, he accepted a position in the drafting department of the Chicago Edison Company, the forerunner of the Commonwealth Edison Company. Later he was transferred to engineering testing work, and in 1897 he was made foreman of the company's construction department. There he remained until 1900, when he entered the company's sales department, handling the sales of the company's old apparatus and equipment and devoting considerable time to making valuations on isolated plants. In 1901 Mr. Lloyd was made assistant superintendent of construction, and in 1906 he was promoted to his present position of general contract agent of the Commonwealth Edison Company. Aside from his activity in the work of the general association, Mr. Lloyd has always taken a lively interest in the work of the Commercial Section of the N. E. L. A., having been one of its founders. He has contributed largely to the success of the section and was made its chairman at the 1912 convention. Mr. Lloyd is a close student of rate-making principles, and has been an active member and supporter of the work of the rate-research committee, of which he has served as chairman.

Jovian Rejuvenation

Among the activities of the week was a rejuvenation of the Sons of Jove, held at the Exposition grounds under the direction of Tribune Thomas E. Collins, San Francisco. A parade with many fantastic illuminated floats and many hundred Jovians in line proceeded up and down the "Zone," ending at the dance hall of "Toyland," where the initiation ceremonies were performed. A class of fifty candidates was initiated.

Entertainments

On Wednesday the Pacific Gas & Electric Company gave a dinner in honor of Mr. Samuel Insull at the Bohemian Club which was participated in by the prominent men in the industry attending the convention. Immediately after the dinner there was a special illumination of the Exposition grounds and fireworks for the benefit of the delegates.

The entertainment committee, headed by Mr. W. W. Briggs of the Great Western Power Company, and the ladies' auxiliary committee, headed by Mr. T. E. Bibbins of the General Electric Company, made ample provision for very lavish entertainment.

An all-day sightseeing trip was arranged for the ladies on Friday. The party went by boat to Sausalito, where the members transferred to electric trains which took them to Mill Valley, a town situated at the foot of Mount Tamalpais. From there the party took special trains to the summit, where an excellent view of San Francisco, the bay and the surrounding country was obtained. Luncheon was served in the tavern on top of the mountain. Leaving the summit, the party coasted down the incline in gravity-propelled cars to Muir Woods, where an opportunity of viewing the great redwood trees was afforded. In the evening at the Exposition the closing event was a water pageant on the lagoon of the Fine Arts Palace, in which native Hawaiians took part.

N. E. L. A. Convention Papers and Discussions

Abstracts of Reports and Papers Read at the Thirty-eighth Annual Convention, Held at San Francisco from June 7 to June 11, 1915

THE news features of the National Electric Light Association convention, held in San Francisco this week, are described in the article published on preceding pages, which is a survey of the various sessions and also of the matters of general interest. In this section there are grouped by general subjects the customary abstracts of papers and committee reports and the discussions thereon.

RELATIONS WITH THE PUBLIC

Public Policy Committee Report

This year concludes ten years of service of the public policy committee, of which Mr. W. W. Freeman is chairman. In this period the companies have become accustomed to policies and methods now regarded as normal but which seemed at first extremely radical to some of the members. The committee expresses gratification that the conclusions and recommendations in these matters have been accepted so generally by member companies and that further experience continues to confirm the soundness of the association policies.

The past year has been one of anxious uncertainty in most business quarters. Beginning with contraction in business activities due to political and legislative changes, and followed by the outbreak and active continuance of the European war, the entire commercial fabric has been subjected to severe strain. It is evident, however, that for several months conditions have been improving surely, if slowly, and the industry has demonstrated again the stability and reliability of its investments and earnings under adverse business conditions.

It has become clear to students of finance that public utility companies, and especially electric light companies, are affected in less degree by varying financial and industrial disturbances than most other business enterprises, and as this fact becomes recognized more fully by the investing public, the securities representing electrical properties will become established still more thoroughly in their confidence and esteem. Member companies will do well to broaden the market for their securities by keeping their local investors informed as to the relative merits of electric lighting and other securities, and by a policy of frank publicity as to their earnings and financial condition. It would also be well, the committee adds, to give special attention to legislation restricting or affecting the investment of savings and trust funds, so that electric lighting bonds may receive due recognition as conservative and safe investments.

REGULATION

The committee regrets to note a disposition recently marked in several states to give commissions a political complexion, which is likely to curtail their experience and efficiency as quasi-judicial bodies. It ought to be self-evident, the committee continues, that knowledge and experience are essential to enable a commissioner to serve the public expeditiously and efficiently without injustice to the companies under his jurisdiction, and that the longer he remains in office, without physical or mental infirmity, the greater must be his value to the public. In no sense is his usefulness enhanced or diminished by reason of his being a Republican, Democrat or Progressive. Even if partisan politics seem to demand an occasional change in personnel to correspond to changed party control, such substitutions should be made with great care and always with due regard to the responsibilities and requirements of the office.

The question of what is a reasonable rate of return has been passed upon in specific cases by the commissions of at least fifteen states and, in cases of electric properties, 8 per cent is the figure which has been adopted generally; 7 per cent has been fixed in two cases and as high as 10 per cent in as many others. It has been recognized generally by the commissions that the prime necessity, from the public standpoint, is to insure adequate and reliable service, and that the measure of return to be allowed an electric company should be at least the measure of wages which must be offered to capital to secure its ready employment in the business.

The more thought that is given to the subject of rates, the more evident it must become, the committee declares, that no single factor can be used for the determination of just and proper rates. The question must be determined by fair-minded conclusions drawn from the considerations involved in each case. As stated by the Massachusetts Commission in the Northampton gas case, the matter is not one of "mathematical demonstration" but must involve the exercise of "sound judgment." With a full appreciation of these facts, less importance will be attached to elaborate appraisals of property for rate-making purposes, especially when the time, labor and expense involved are understood. Where appraisals are undertaken (which may be of distinct advantage in proving the intrinsic value of capital securities), it is important that companies making them shall understand and be careful to include all of the elements of value, both physical and intangible, which go to make up a proper and complete appraisal.

PROTECTION FROM COMPETITION

That protection from competition is proper and desirable where existing companies are furnishing adequate and satisfactory service at reasonable rates is becoming recognized more generally from year to year. Seventeen states now provide that competing companies, before beginning business, must obtain certificates of necessity from the commission, and in eight of these states the provision applies to municipal as well as private plants. That this principle is correct and is in the interest of the public not less than the utility companies is confirmed not only in these provisions of laws, but in the frequent exercise of such authority by commissions. No one will claim that communities should be deprived of good service at the lowest consistent rates because of the prior occupation of the field by an inefficient company or one indifferent to its public responsibilities. The very fact that competition is withheld only under conditions of adequate and satisfactory service gives the commissions a most effective means of enforcing proper service and proper rates from existing companies. The exercise of this discretionary power by the various commissions has, so far as the observation of the committee goes, been proper and beneficial. In some cases it has led to definite refusals; in other cases certificates have been withheld conditionally until specified improvements were effected and then refused, and in other cases competing companies have been en-

couraged properly and qualified. This is as it should be, provided the merits of each case are ascertained fairly and fully and decision rendered accordingly.

MUNICIPAL OWNERSHIP

Municipal ownership, the committee says, is probably neither more nor less an issue than it was a year ago. The committee continues to believe that municipal ownership and operation of lighting utilities is against the public interest excepting where, on account of local conditions, private capital is not readily available for such service. As an economic proposition, municipal ownership has not "made good." The apparent success in the cases claimed is due primarily to the fact that usually only operating expenses are charged against such plants, whereas interest and other fixed charges are provided through general taxation. This is indicated in almost every case where thorough examination has been made. As a question of economics, municipal ownership can never seriously threaten member companies; as a socialistic program it will continue to have ardent advocates.

PUBLIC RELATIONS

For years the committee has been preaching the gospel of first-class service, reasonable rates and liberal treatment of the public as essential to the permanent prosperity of any utility company. Together with these cardinal principles, emphasis has been placed upon the education of employees for their own welfare as well as their companies', and definite plans have been advocated and generally adopted for bettering the conditions of employees and increasing their loyalty and efficiency to their companies in the service of the public. It seems impossible to the committee that any company which is familiar with the fundamental ethics of the industry can ignore the principles and policies for which the association has stood openly for years. It is doubtless true that there have been electric companies as well as others which have failed in times past to recognize and meet fully their obligations to the public, although it is doubtful if the cases have been as numerous as indiscriminate criticism would imply.

The committee, however, believes that the time has come to stop talking about the shortcomings of years long past as excusing a disinclination to give credit where credit is now due. The electric-lighting companies of this country have reason to feel proud of their record of public service, which in the main has been performed honestly and efficiently It can be claimed fairly that no single industry has contributed more to the comfort, convenience and welfare of the public in the past decade, and when it is realized that practically all of the gain in economies effected through the advance of the art during such time has been given with practical entirety to the public, the record of service is especially gratifying.

It may be well to ask, adds the report, whether the time has not arrived when it is fitting to say something about the obligations of the public to recognize and reward services faithfully and efficiently performed. The companies are, in a very real sense, public servants; their prime obligation is to serve the public, but their measure of reward ought to be reasonably proportionate to the value of the service rendered.

There is probably no other commodity generally used by the public to-day in which the seller has so little voice in determining the prices and profits received as in the case of electric and similar utility service. The capitalization employed, the character and quality of the service, the measuring devices used in determining the amount of service, and the price charged, are now fixed in the last analysis by the public.

There is danger that through too drastic restriction the desirable incentive to unusual efficiency will be destroyed, and that the public will be the greatest sufferer thereby. There is real need to-day of an intelligent conception of the respective duties of public master to public servant as well as of public servant to public master. A servant who is ill fed and underpaid cannot render good service, whether such servant be an individual or a public service corporation. What is needed most is an appreciation of the actual facts, with a knowledge of which the public is inclined to be fair. It is difficult, however, to get the facts before the mass of people in any community, especially where they are being misrepresented ignorantly or wilfully by certain newspapers or other elements in the community whose interests seem to lie in constant agitation rather than in the adjustment of difficulties.

It is undeniable that a strong and efficient public utility in any community is a distinct asset to the entire community. It is invariably one of the largest taxpayers, and through its service promotes industrial development and general business activity.

In view of these facts, it is entitled to the good will of at least the intelligent members of the community, and the withholding of such good will is of direct disadvantage to all business interests. From selfish motives, if not otherwise, the business people in every community should exert every reasonable effort to promote a sympathetic understanding of the difficulties and problems confronting utility companies, in order to secure the measure of public co-operation to which they are entitled by reason of a service honestly and efficiently supplied, and in which the general public, whether they appreciate it or not, are essential partners. The committee suggests that member companies should insist upon the recognition of their just claims for public support, believing that an aggressive policy with this object in view will attract attention and win respect.

"While gathered at the 'Golden Gate' and in an atmosphere of celebration of the newer developments and achievements of our beloved country," the report concludes, "it is surely fitting to predict with confidence that honesty and efficiency in public utility service will not fail of ultimate recognition and adequate reward."

Municipal Regulation of Public Utilities

In a paper on "Municipal Regulation of Public Utilities," Mr. John H. Roemer, chief legal counsel of H. M. Byllesby & Company, said that the advocates of regulation by municipal councils do not seem to realize that state regulation is finding its justification in an increasing degree in the complexity of civilization in this country and the growth of the public service industries to meet the needs of that civilization in the most economical way possible. Long-distance transmission of energy ignores municipal boundaries. The marked tendency for large central hydroelectric generating plants with transmission lines to displace small independent plants is a fact neither fully known nor appreciated.

Mr. Roemer declared that the adjustment of the rights of various municipalities served by the same corporation and physical system requires an impartial central agency which shall administer solely with an eye to the welfare of the whole territory involved and of the state itself. It is highly undesirable that a municipality should have power to block the most economical development of the various public-service industries for the best advantage of the state as a whole. The subject of regulation is exceedingly technical and needs the action of a highly trained body with personal centralized responsibility. Municipal councils are principally legislative in character, change in personnel from election to election, and, from their very nature, are incompetent to deal with problems requiring special skill and training.

In closing, Mr. Roemer conceded frankly that purely local matters should be managed by the localities involved and that no institution is perfect. If the method of regulation of utilities is susceptible of improvement it should be improved. The subject is one for care and study. The need for state regulation has become greater rather than less.

Public Utility Regulation in California

In his paper Mr. Max Thelen, president of the Railroad Commission of California, said that the development of hydroelectric energy in California has resulted in interesting and difficult problems which must be solved by the public authorities charged with the duty of supervising public utilities. The first of these problems is the regulation of rates; and with a single utility serving 175 cities and towns, with many different classes of service, the problem of regulating the rates has become very complex.

Another important problem in connection with the regulation of electric utilities is the construction of extensions. The commission is not satisfied with the attitude of certain utilities in northern and central California in the matter of the construction of extensions, particularly in cases in which the utilities have monopolies. When the utilities have a monopoly, Mr. Thelen said, they cannot expect to sit back in complaisant contentment and take all the advantages accruing to them from the new policy of public regulation without being willing to make the necessary extensions to serve the territory which they claim as their own. In the Eastern sections of the country it is seriously urged by opponents of regulation that the effect of public supervision is to make it more difficult for utilities to secure the capital necessary for additions, betterments and extensions. The same suggestion is made occasionally in California, although for political purposes.

TO PROTECT INVESTORS

Commenting on the wildcat financing of the past, Commissioner Thelen said that the California commission proposes to see that when an investor living in other portions of the United States invests his money in securities issued by California public utilities he may do so with reasonable assurance that the securities are issued honestly, that the proceeds will be applied honestly, and that, though the investor may live thousands of miles away, his interests will be reasonably protected by public authorities who insist on honesty and security in public-utility investments in the State. Mr. Thelen believes in direct dealing between the utility and the general public in the locality in which it does business.

As a result of public regulation of utility securities Mr. Thelen hopes that the small investor may regard them ultimately in somewhat the same light in which he now views federal, state and municipal securities and that it may then be possible for the utility to sell a large portion of its securities at home, thus saving the large commissions heretofore paid to Wall Street. The commissioner referred to the success of the Pacific Gas & Electric Company in disposing of millions of dollars of first preferred stock in this way, and said that Mr. A. F. Hockenbeamer, treasurer of the company, had told him that up to date the average cost of selling this stock has been about 65 cents per share. When contrasted with the sum of $5 for every $10 which California utilities have been compelled to pay to the middleman frequently for placing their securities out of the State, the immense advantage, both to the utility and the public, of this method of selling securities is obvious at once. Without public supervision of utility securities the necessary confidence to render this method of selling securities successful would generally be lacking.

GENERATION AND TRANSFORMATION

Report of Committee on Prime Movers

The report of the committee on prime movers, of which Mr. I. E. Moultrop was chairman, summarized important developments in stokers, economizers, steam turbines and condensers. The committee expressed the opinion that probably the most important recent developments have been in surface condensers. Data were given regarding the performance of economizers installed in the Fisk Street station of the Commonwealth Edison Company, Chicago. Attention was called to the importance of providing instruments in the boiler room to show firemen the performance of furnaces and boilers. Among other subjects treated in the report were the effect of air leakage on fuel economy, methods of improving the performance of old condensers, electrical-resistance method of determining surface-condenser leakage, ventilating and cooling of electrical equipment, the deleterious effects of sodium carbonate on boilers, methods of burning coaldust, and means for computing the commercial value of various grades of coal from the ash content.

Reference was made to three recent notable water-power developments, typical of high, intermediate and low-head practice respectively, special emphasis being laid on high-head practice. The opinions of a large number of engineers, manufacturers and operators on the relative advantages of open-type and closed-type governors were included so the reader might draw his own conclusions. A statement was given of the fuel-oil production and probable supply in the United States and Mexico, which indicates that vast quantities of this fuel are available. The progress of Diesel-engine development in this country was outlined and brief reference was made to installations of Humphrey pumps and gas engines. A letter from Prof. R. H. Fernald, which concluded the report, contained an outline of gas-producer practice in this country and Europe. In the appendix were described several methods of measuring plant feed-water under test and under operating conditions.

Discussion

Written discussions were received from Mr. John Harisberger and Mr. Henry Hull, Puget Sound Traction, Light & Power Company, Seattle, Wash., and from Messrs. Rosencrantz and Allen, Oregon Agricultural College, Oregon, Ore. Those who took part in the oral discussions were Mr. J. P. Jollyman, Pacific Gas & Electric Company, San Francisco; Mr. Philip Torchio, New York Edison Company; Prof. W. D. Peaslee, Oregon Agricultural College; Mr. F. H. Varney, Pacific Gas & Electric Company, San Francisco; Mr. O. B. Coldwell, Portland (Oregon) Railway Light & Power Company; Mr. R. J. McClelland, Electric Bond & Share Company, New York, and Mr. J. A. Lighthipe, Southern California Edison Company, Los Angeles.

Messrs. Rosencrantz and Allen emphasized the need for boiler-room economy, and stated that little had been done to solve the problem of controlling oil combustion. It was suggested that further attention be given to developing instruments for indicating and recording the rate of combustion and the flow of air and oil. Mr. Torchio spoke of the great saving in fuel consumption resulting from the use of economizers, but he stated that the highest efficiencies are to be obtained only in stations purposely designed for their use, and that economizers are too expensive as additions to old stations unless it is convenient to install blowers for forced draft. Professor Peaslee described a conductivity meter for

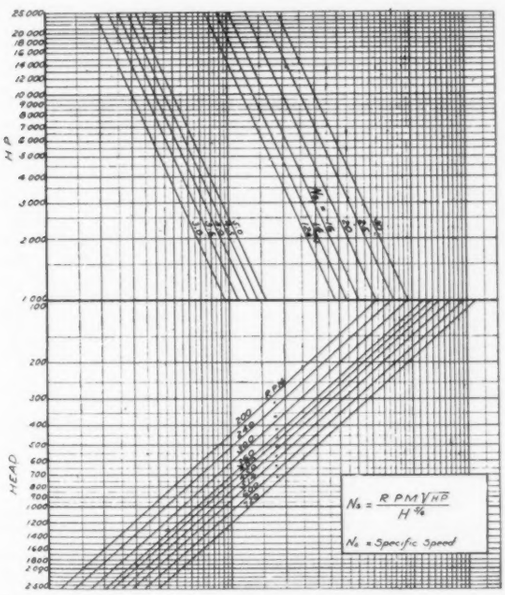
measuring the flow of water by the salt-solution method without chemical analysis.

Mr. Coldwell described experiments which he had made in endeavoring to devise a means of measuring the flow in a 9-ft. penstock by testing the conductivity of a salt solution mixed with the water.

Mr. Lighthipe said that the last of three steam turbines installed by the Southern California Edison Company in the last five years showed higher efficiency than the second, and the second higher efficiency than the first. He pointed out that to attain still higher boiler efficiency better instruments are needed. A turbine recently installed for his company easily developed 256 kw-hr. per barrel of oil while under test, but when the experts left and the recording instruments were no longer in use the output dropped to about 215 kw-hr. per barrel of oil. He said that as high as 300 kw-hr. per barrel of oil had been developed under specially favorable conditions in the Redondo plant. He predicted that the next step would be the development of means for using natural gas as fuel, after which the gas now wasted at the oil fields will be preserved for use and the oil will be shipped to other markets.

Practice in High-Head Hydraulic Plants

The types of pipe line, gate valves, waterwheels, generators and control equipment employed in high-head hydroelectric plants along the Pacific Coast were described in a paper by Mr. J. P. Jollyman. Present practice



SPECIFIC SPEED CURVES FOR IMPULSE AND REACTION WATERWHEELS

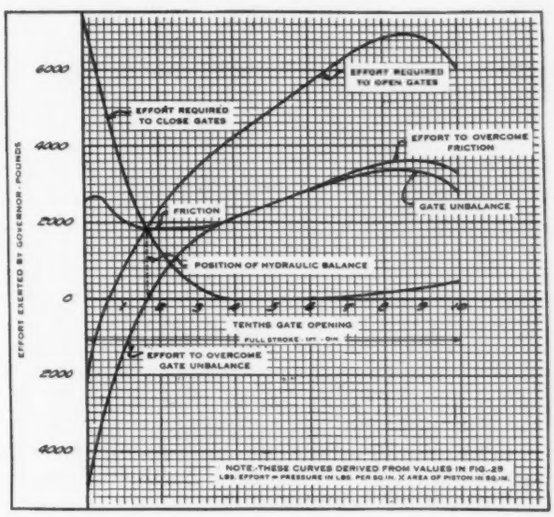
was reported to favor the use of steel pipes with either riveted or welded joints, economy in material being afforded by tapering the pipes where considerable changes in elevation occur. Compensation for expansion of pipes is usually provided by long-radius bends; slip joints being used only at points where the hydraulic pressure is not excessive. Waterwheels are now connected with the pipe lines by Y-pieces instead of by a common header. Needle-valve and single-disk gates are specially adapted to high-head requirements. Francis turbines were recommended as best suited for heads up to 700 ft. and specific speeds above 12, while impulse wheels are preferable on heads up to 3000 ft. or over, with specific speeds as high as 4.

In general, the most desirable speeds for waterwheel-driven generators rated at 3000 kw to 15,000 kw are in the neighborhood of 400 r.p.m.; therefore, impulse wheels having high specific speeds or Francis turbines having low specific speeds must be employed. For regulating the water pressure at the foot of pipe lines inverted needle valves have been found satisfactory, especially when operated synchronously with the turbine governor. Cut-off hoods for deflecting water jet from the wheel, and deflecting nozzles used alone or in combination with needle valves, may be employed to govern impulse wheels.

If unchecked by a governor, waterwheels may attain 200 per cent of rated speed, therefore generators used with them should be designed to withstand the excessive stresses and increases of voltage which are caused thereby. The most desirable method of connecting horizontal-shaft generators with their drivers has been to attach the waterwheels to one or both ends of the overhanging shaft. Where the water in the tailrace fluctuates more than 20 ft. it may be necessary to use vertical-shaft units so that the generators will not be submerged during floods.

Analysis of Waterwheel-Governor Effort

In his paper on waterwheel-governor analysis, Mr. E. D. Searing recounted how in 1908 the Portland (Ore.) Railway, Light & Power Company experienced a partial wreck of its Cazadero hydroelectric station through the sticking of the regulating valve of one of the governors, resulting in the running away of the wheels and bursting of the alternators. Following the wreck, an examination of the wheels showed that the wicket gates were in a partially open position. Accordingly, when ordering new wheels, the company's specifi-


EFFORT EXERTED BY GOVERNOR - POUNDS
EFFORT REQUIRED TO OPEN GATES
EFFORT REQUIRED TO CLOSE GATES
EFFORT TO OVERCOME FRICTION
FRICTION
GATE UNBALANCE
POSITION OF HYDRAULIC BALANCE
TENTHS GATE OPENING
EFFORT TO OVERCOME GATE UNBALANCE
NOTE.-THESE CURVES DERIVED FROM VALUES IN FIG. 29

ANALYSIS OF GOVERNOR EFFORT MADE FROM INDICATOR CARDS

cations called for wicket gates with a tendency to close when released. When installed, however, the operation of the governors was still unsatisfactory and the wear on the gears excessive. The company then decided to undertake a study of the work required of the governors in order to determine, if possible, the cause of the trouble. A preliminary study of the operating features led to the belief that the governors were not of sufficient power to perform satisfactorily the work of regulating in addition to that of overcoming the friction and unbalance of the gates. The problem then became one of analyzing the governor effort, and a series of experiments along this line were made on a number of different waterwheel units.

Each of the three existing methods employed to determine governor effort was discarded after trial as being unsatisfactory, because of either the difficulty of appli-

cation or the unreliability of results. The experience gained in these attempts pointed to the conclusion that the method of securing simultaneous records of pressure on each end of the governor cylinder forms the most satisfactory basis for the investigation of governor effort. Steam-engine indicators proved to be well adapted to this purpose, and continuous records of the varying pressures on each side of the governor piston throughout one cycle of operation were obtained.

From the indicator cards the results were drawn up in the form of curves showing the relation between governor effort and gate opening during the opening and closing strokes. In addition, the governor efforts required to overcome friction and gate unbalance at each point were separated. From a consideration of these curves, the author points out that the margin necessary to insure regulation under operating conditions should be about 100 per cent of the maximum effort to move the gate, and that empirical formulas for determining governor capacity should be developed embodying factors directly relating to friction and gate unbalance. The rise of pressure in wheel casings, high pressure in governor cylinders and overspeed devices were features incidental to the analysis of governor effort which developed during these investigations and received some attention.

Oil Fuel for Standby Plants

According to the paper entitled "Oil-Burning Standby Plants," by Mr. C. H. Delany, the Pacific Gas & Electric Company has found that oil fuel has many advantages over coal for operating standby stations, especially when such plants must be kept in readiness to carry indefinite loads without notice. Boiler efficiencies as high as 80 per cent have been obtained, for the reasons that less excess air is required for oil combustion, very little energy is required to carry away furnace gases, leakage through the boiler setting is small because of the lower draft employed, and banked fires are not required. From 1 to 4 per cent of the total steam generated is required to atomize the oil so that it can be burned efficiently. About 0.3-in. draft has been found sufficient to operate boilers at 200 per cent rating. Starting with cold water in the boilers, it has been possible to raise steam with oil-burning equipment in twenty-five minutes to thirty minutes.

At the standby station in San Francisco all of the boilers necessary for supplying city service are kept under a light load continuously so they may be forced to carry extra load whenever hydroelectric service is interrupted. At the Oakland and Sacramento plants groups of boilers are fired in rotation so that they will always be hot and ready to generate steam quickly. Tests have shown that starting with a light load, carrying a short peak load, and then returning to the original condition in three minutes, about 0.08 lb. of oil is required per rated boiler-hp. The amount of fuel required to maintain 160 lb. steam pressure when no steam is being used has been as low as 0.038 lb. per hour per rated boiler-hp, or about 1.4 per cent of the quantity required to operate the boiler at its rated value. Other tests to determine the amount of fuel required to restore normal pressure in boilers showed unit fuel consumptions ranging from 0.105 lb. to 0.685 lb. per boiler-hp, depending on the construction of the dampers and on the number of hours the boilers had been standing unfired or disconnected from the steam mains. During normal operation of the Oakland plant about 1.22 lb. of oil is used per day per rated boiler-hp to keep the nine boilers hot. In addition to this there is the cost of labor, making a monthly unit expense of about $3.18 per kw of equipment installed, which is in addition to the amount involved in keeping the turbines in operation.

COMPARISON OF WESTERN COMPANIES' REVENUE AND EQUIPMENT

Name of Company	Number of Electric Consumers	Gross Electric Revenue*	Kilowatt-Hours Generated		System Load-Factor (per Cent)	Miles of		Plants Installed				Gross Revenue All Departments
			Hydro.	Steam		High-Voltage Transmission	Overhead Distribution	Hydro.		Steam		
								No.	Kw	No.	Kw	
Portland Railway, Light & Power Co.	37,938	$2,241,834	162,125,167	22,640,982	47.6	277	6880	5	43,000	5	22,500	$6,273,170
Washington Water Power Co.	29,119	2,083,597	.....	.....	65.3	631	748	3	40,000	..	.....	2,104,526
Northwestern Electric Co.	6,497	313,307	.....	825,590	50	65	105	1	12,000	1	7,500	.....
Oregon Power Co.	8,365	325,365	.....	7,867,882	45	92	729	1	500	..	.....	325,365
British Columbia Electric Co.	.....	.....	.....	350,024	45	188	66	4	65,900	..	.....	.....
West Kootenay Light & Power Co.	722	413,884	.....	.....	79	250	60	3	23,000	..	.....	.....
Western Canada Power Co.	1,190	.....	.....	.....	52	55	170	1	20,000	..	.....	.....
Puget Sound Traction Co.	26,046	1,830,416	.....	4,200	50	370	425	3	55,000	2	20,500	6,917,910
Pacific Power & Light Co.	16,572	.....	39,001,288	3,714,999	43.0	476	777	10	13,400	5	4,900	905,816
Pacific Gas & Electric Co.	148,957	8,759,449	374,957,993	101,639,560	60.6	1534	3685	10	90,310	4	81,700	17,220,504
Mount Whitney Power & Electric Co.	5,811	638,215	.....	1,682,100	56	179	1035	4	8,850	1	6,750	643,728
Great Western Power Co.	17,000	2,664,204	.....	31,790,000	65	310	955	1	52,500	2	31,200	2,681,990
Western States Gas & Electric Co.	8,719	588,052	.....	1,208,700	....	201	341	1	3,000	1	1,500	778,573
Pacific Light & Power Corporation.	.....	2,639,318	.....	212,192,288	48	810	2526	8	74,300	3	.....	.....
San Joaquin Light & Power Corporation.	19,934	1,568,197	106,828,450	1,093,903	64.0	704	1770	4	27,800	..	.....	1,568,187
Nevada-California Power Co.	2,429	956,633	.....	.....	64	359	155	3	18,750	..	.....	968,288
Southern Sierras Power Co.	2,516	443,449	.....	1,378,245	56	274	440	2	3,480	1	5,000	465,652
Southern California Edison Co.	108,439	4,461,807	202,819,110	81,412,505	61.1	423	1803	6	31,600	3	57,500	4,855,141
Sierra & San Francisco Power Co.	3,717	1,082,065	9,984,700†	.....	31.2	480	249	3	43,375	1	18,000	1,139,292
Snow Mountain Water & Power Co.	6‡	127,963	.....	.....	58	106	....	1	6,000	..	.....	.....

*Revenue from residence and industrial consumers. †Total generated. ‡Sells to distributing companies.

Hydroelectric Development in the West

The sub-committee on water-power developments on the Pacific Coast, of which Mr. P. M. Downing was chairman, presented an illustrated report containing a map and tabulated data relating to practically all hydroelectric plants in the western part of North America. Brief histories of many of the organizations were given, with a list of their officials. The map presented showed the routes followed by all hydroelectric transmission lines west of Denver. The order in which these plants were developed chronologically was given in one table, with the location of the respective generating stations, their ratings, line voltage, length of the transmission system and its terminal, and the name of the present parent company. Other data were given to make evident the growth in number and total rating of hydroelectric plants in California. These showed that in

twenty-two years seventy-nine stations have been built, the average rating per station in that time having increased from 480 kw to about 55,000 kw. From information given in another table it appears that the water-power available from the Sacramento River has been less utilized than that from any of the other large rivers in the West, only 184,437 kw having been developed out of a possible 3,435,000 kw. The San Joaquin and Kern Rivers rank next in the list of only partially utilized water-powers. Power from the Klamath and Rogue Rivers has been more completely developed than that from any of the others named. The amount of power at present being developed in California is 436,045 kw (about 6.4 per cent of that possible), in Washington 300,000 kw, and in Oregon over 100,000 kw. Extracts from the data for each company are shown herewith.

With all of the hydroelectric installations that have been made during the past few years there is still a field for great development. With the possible exception of a few instances of over-development in the Pacific Northwest, electric-service companies on the Pacific Coast have not built ahead of the demand, declared the committee. As a great deal of the land on the coast has been set aside as forest reserve, companies have not been able to acquire title in fee to the property at any price. Furthermore, easements and rights-of-way across such property are terminable at the pleasure of the Secretary of the Interior. These conditions, with other government requirements, have made it very hard to interest investors in developments which must be made on forest reserve. There is one company on the Pacific Coast to-day using a large amount of steam-generated power because it has been unable to finance the further development of its water-power property, a part of which would fall within the forest reserve. Another company, having under construction a plant which would have had an ultimate rating of 50,000 kw, found that its canal right-of-way would have to cross one corner of the forest reserve, so rather than sign the required government permit and thereby cloud the title to the property, an inverted siphon was constructed around the reserve at an extra expense of about $70,000.

The loads which exist on the Pacific Coast have been acquired by educating the people to do things electrically. There are not so many manufacturing industries using electricity as there are in the East, so that the load is more diversified than where manufacturing is a more important factor. As with every other new industry, the growth of electrical business on the Pacific Coast has been slow. At first flat rates were offered to both lamp and motor users. Now the companies are having great difficulty in changing to a meter basis of charging for energy without securing the ill will of the consumers. Considerable effort was also expended in developing the present irrigation load. In many cases electric-service companies replaced gasoline-engine-driven pumps with electric motors at their own expense, with the understanding that if the consumers were not better satisfied with electrical operation the plant would be restored to its original condition with no expense to the consumer. Dredge operators have not hesitated to adopt electric drive where energy is available, but it is only during recent years that oil-well operators have recognized the advantages of using electricity. In every case the use of electricity has been encouraged by liberal line extensions.

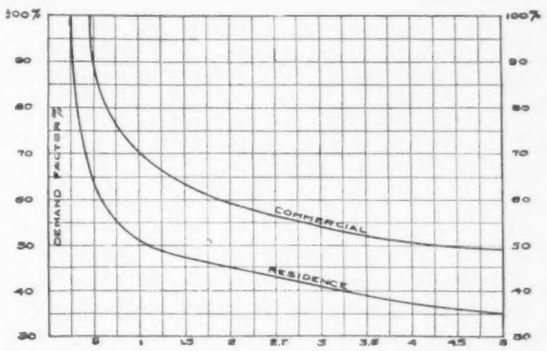
Discussion

The four papers by Messrs. Jollyman, Searing, Delany and Downing were discussed as a group. Written comment was presented by Mr. M. T. Crawford, Seattle, and by Messrs. J. P. Jollyman and Charles H. Delaney, both of the Pacific Gas & Electric Company, San Francisco. Oral discussion was contributed by Mr. E. A. Weymouth, Sacramento, and Mr. Edwin A. Rogers, San Francisco, both of the Pacific Gas & Electric Company.

Mr. Weymouth described a boiler installation in which high economy at fractional loads was desired. The boiler was provided with a special steel casing carefully insulated to reduce radiation. Tests on this plant showed an efficiency at one-half load fully 2 per cent higher than the full-load efficiency, with a proportional efficiency at three-quarters load. He presented interesting statistics relating to the time required to get up steam under varying conditions in boiler plants.

The Application of the Diversity-Factor

"The diversity-factor reduces the amount of capital required to carry on a business and by increasing the load-factor makes it possible to produce a greater income per dollar invested," pointed out Mr. H. B. Gear in his paper on "The Application of the Diversity-Factor." To clear up any confusion from the use of existing



DEMAND FACTORS OF RETAIL CONSUMERS

data on load-factors and demand-factors of various classes of customers, a paper presented by Mr. E. W. Lloyd in 1909 and a paper by Mr. Gear presented before the Association of Edison Illuminating Companies and the A. I. E. E. in 1910 were discussed by Mr. Gear in the opening of the present paper. In the Chicago system the power load of that portion under observation for report in 1910 was only about 33 per cent of the evening load. The diversity between transformers would therefore be higher where the light and power loads are more nearly equal, and the diversity-factor of 1.3 in the 1910 analysis might be increased to 1.5 or more. Also, the diversity-factor from feeders to substation bus reported as 1.15 was the average of the feeders of six substations and varied from 1.02 where power business was small to 1.35 where the power load was 40 per cent of the lighting load, a variation due to the diversity between general power and evening lighting. This diversity-factor of 1.15, Mr. Gear said, should not be used indiscriminately on other systems.

The diversity-factor of standard definitions, the author pointed out, implies the existence of a group of consumers and is a group diversity-factor. It reveals nothing as to how much any individual user or group of users contributes to the reduction in demand. He therefore called attention to a further definition, termed individual diversity-factor, as follows: "Individual diversity-factor is the ratio of the maximum power demand made by a subdivision of a system or part of a system to the coincident demand made by such subdivision at the hour of the maximum load upon the source of supply." In the case of retail consumers, usually small and numerous, it is usual to ignore the individual diversity-factor and treat users of this class on the basis of group diversity-factors. The individual diversity-factor then comes into use in cases where it is

greater than the group diversity-factor. The group diversity-factor is a measure of the reduction of investment made possible at the source of supply because of its existence. The individual diversity-factor is a measure of the proportion of such reduction contributed by each individual of the group.

The direct relation between group diversity-factor and group load-factor is shown. For a group of retail users the load-factor at the transformer supplying the group is equal to the average individual load-factor times the group diversity-factor. This rule applies to any class or group of users or to a group of substations of a large system. The author showed that there is no relation between individual diversity-factors and individual load-factors of substations or wholesale users by referring to the accompanying table of data for the year 1914 from ten substations serving general light and power customers in a part of Chicago. This table shows substation No. 1 with a load-factor of 35 per cent and individual diversity-factor of 1.06, while substation No. 2, with practically the same load-factor, has an individual diversity-factor of 1.26. One of these substations with the same load-factor thus has an individual diversity-factor higher than the group diversity-factor, while that of the other is lower.

TABLE I—ASSUMED ALTERNATING-CURRENT CENTRAL-STATION SYSTEM

Links of Systems	Investment	Group Diversity Factor	Kw Useful Load	Full-Load Efficiency	Actual Kw Demand	Investment per Kw
Generating station	$2,350,000	....	16,050	.....	20,000	$117.50
Transmission system	450,000	....	.....	0.95	.....	21.50
Substation	800,000	1.1	17,650	0.912	21,000	38.00
Distribution lines	2,750,000	1.15	20,300	0.802	23,200	119.00
Transformers	350,000	1.3	26,400	.....	26,400	13.00
Meters	500,000	....	.....	.....	.....	.....
Miscellaneous	900,000	....	.....	.....	.....	.....
Total	$8,100,000	....	.....	0.802	.....	.....

To illustrate the effect of diversity-factor in reducing investment, the author assumed an alternating-current central-station system of 25,000-kw generating plant rating, with a maximum load of 20,000 kw at a cost of $405 per kw load. The apportionment of capital invested he arranged as Table I, roughly representative of an average system in a medium-sized city without much suburban distribution.

These data are applied to a group of fifteen residence consumers with an average demand of 0.6 kw each and a group diversity-factor between consumers of three, with the results as shown in Table II. A similar group of fifteen consumers using commercial lighting or retail power requires an investment as set forth in Table III. From the standpoint of return on capital invested, the commercial group has an advantage of about 10 per cent over the residence group under the conditions assumed. The effect of rapidly decreasing investment per kilowatt resulting from increasing the density of load the author shows as an important consideration in this connection when applying the average cost per kilowatt for distribution lines. He stated that it may be possible in some cases to multiply the load of a city block by fifteen or twenty with an increase of only two and one-half or three times the total investment. In some sections of Chicago where calculations have been worked out the investment per kilowatt in the distribution system ranges from $310 with ten residence customers per block, using approximately 1.25 kw at the transformer, to $45 per kw with 200 consumers per block, taking about 24 kw at the transformer.

TABLE II—INVESTMENT FOR GROUP OF FIFTEEN RESIDENCE LIGHTING CONSUMERS

	Group Diversity Factor	Kw Useful Load	Full Load Efficiency	Kw Actual Demand	Investment
Fifteen meters at $7	3	9	.....	....	$105.00
Transformer capacity	1.3	3	.....	3.00	39.00
Distribution lines	1.15	2.31	0.97	2.38	283.00
Substation	1.1	2	0.91	2.2	83.50
Transmission	....	1.82	0.845	2.16	46.50
Generating station	....	1.82	0.802	2.27	267.00
Miscellaneous—12.5 per cent	.....	....	.....	....	103.00
Total	4.92	....	.....	....	$927.00

Average demand at meter assumed at 0.6 kw for each consumer.
Investment per consumer, $61.80.
Investment per kilowatt of generating-station demand, $408.00.

TABLE III—INVESTMENT FOR GROUP OF FIFTEEN COMMERCIAL LIGHTING OR RETAIL POWER CONSUMERS

	Group Diversity-Factor	Kw Useful Load	Full-Load Efficiency	Kw Actual Demand	Investment
Fifteen meters at $7	1.4	13.5	.....	....	$105.00
Transformer capacity	1.3	9.64	.....	....	125.00
Distribution lines	1.15	7.42	0.97	7.65	919.00
Substation	1.1	6.45	0.91	7.10	270.00
Transmission	....	5.87	0.845	6.95	149.00
Generating station	....	5.87	0.802	7.33	862.00
Miscellaneous—12.5 per cent	....	.....	.....	....	363.00
Total	2.31	.....	.....	....	$2,724.00

Average demand at meter assumed at 0.9 kw for each consumer.
Investment per consumer, $181.60.
Investment per kilowatt of generating-station maximum, $371.00.

Discussion

Mr. Gear's paper on diversity-factor was discussed by Messrs. Henry W. Peck, Schenectady (N. Y.) Illuminating Company; W. G. Vincent, Pacific Gas & Electric Company, San Francisco; H. F. Jackson, Sierra & San Francisco Power Company, San Francisco, and H. B. Gear, Chicago.

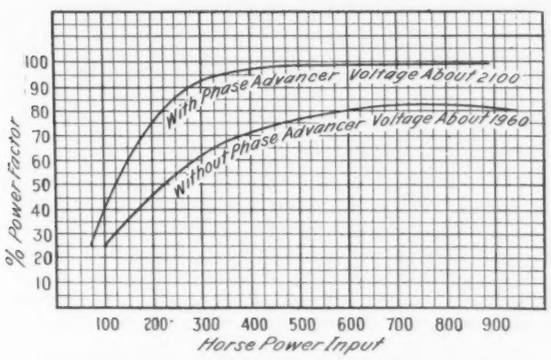
Report of Committee on Progress

This report, which was a continuation of the general report on progress by Mr. T. C. Martin, deals at considerable length with proposed national legislation on the conservation of water-powers and summarizes a great deal of valuable evidence regarding the injurious effect of various proposed restrictions. It was pointed out that in many cases the public will suffer more by such limitations than will those who devote their energy and money to the development of water-power. Considerable space was devoted to extracts from the California Railroad Commission's rules relating to inductive interference caused by transmission lines. Reference was made to the large transmission system in Texas which is fed by steam generating stations. Particular attention was called to the necessity of designing auxiliary steam stations so they will be able to carry the maximum peak loads during the longest recorded period of low water, especially when that period coincides with the time of heavy load. Attention was also called to features of hydroelectric development and generating-station, transmission-line and substation operation. The report concluded with a brief outline of hydroelectric developments in foreign countries.

TRANSMISSION AND DISTRIBUTION

Report of Committee on Electrical Apparatus

Descriptions of recently developed electrical apparatus and a switchboard manual intended to serve as a guide in selecting switchboard and instruments made up the bulk of the report of the committee on electrical apparatus, of which Mr. L. L. Elden was chairman. Attention was called to the gradually increasing ratings which can now be obtained in single generating and transforming units. Reference was also made to port-



EFFECT OF PHASE ADVANCER ON POWER-FACTOR

able and automatic substations, which are operating satisfactorily at pressures as high as 100,000 volts and ratings as high as 3000 kva. It was pointed out that while synchronous motors will probably maintain their position as power-factor regulators for large transmission systems, phase advancers provide economical means for regulating the power-factor of individual motors. For the protection of operators and apparatus the committee recommended the use of electrolytic lightning arresters and grounded frames with synchronous converters. It was reported that very good service has been obtained from mercury-arc rectifiers by the New York, New Haven & Hartford Railroad. Other electrical equipment described in the report included lightning arresters, oil switches and circuit-breakers, relays, measuring instruments, multi-recorders, high-frequency oscillation testing transformers, feeder regulators, polyphase variable-speed motors, and network protectors. The switchboard manual contained many wiring diagrams of instruments and apparatus to be employed in different kinds of service. The importance of standardizing practice in the purchase of electrical apparatus to conform with the A. I. E. E. Standardization Rules was again brought to the attention of N. E. L. A. members, and emphasis was laid on the benefits to be derived by adhering to the new rules in commercial transactions.

Discussion

The report of the committee on electrical apparatus was discussed by Messrs. J. E. Kearns, General Electric Company; E. P. Dillon, Westinghouse Electric & Manufacturing Company; P. Torchio, New York Edison Company; H. Goodwyn, Jr., Philadelphia Electric Company; H. B. Gear, Commonwealth Edison Company, Chicago; Henry W. Peck, Schenectady (N. Y.) Illuminating Company, and H. F. Jackson, Sierra & San Francisco Power Company, San Francisco.

Mr. Torchio asked for an expression from Western operators of high-tension lines as to results obtained in testing insulators with the high-frequency oscillator. To this Mr. Jollyman replied that the Pacific Gas & Electric Company found two principal causes of insulator failure—insufficient vitrification, admitting moisture, and mechanical strains, leading to fracture. Emphasizing the need for a device to detect weakened insulating material before actual failure, he asked that attention be given to this subject.

On motion of Mr. Jackson, action on this subject was taken as follows: "Resolved, that the technical session recommends to the incoming executive committee the appointment of a special committee to study the high-tension insulator problems; that such committee should particularly investigate the conditions on the Pacific Coast, and that there be appointed sub-committees in different localities to study conditions in such respective localities."

Mr. Peck said that he thought the report on motor rules would form a good basis for future extension, and he suggested that more elaborate rules would be acceptable. To this Mr. Kearns replied that twenty-five men had studied this report for five or six weeks and had redrafted the rules from ten pages into the present condensed form. He thought the rules were applicable to general motor service, but that special conditions would require individual treatment. Mr. Gear cited the case of the Commonwealth Edison Company, which has found it advisable, he said, to distinguish between motors in intermittent service and those of more steady operation. The former are wired for 220 volts and are connected on a circuit independent of the lighting system, with which they would otherwise interfere.

Report of the Hydroelectric and Transmission Committee

Fields for future activities of the hydroelectric and transmission committee were pointed out in its report, presented by the chairman, Mr. M. R. Bump. The committee expressed its regret that no definite governmental policy has been established by legislation regarding water-power development. Attention was called to the fact that the initial investment and fuel expense required in steam plants are about half the values they were five or ten years ago, thus making it all the more necessary to remove legal restrictions to the free development of water-power. The opinion was also expressed that many undesirable restrictive and regulative enactments might have been prevented had the central-station officials impressed upon the public how many difficulties are encountered in hydroelectric development. It was urged that the recommendations of the sub-committee on electrification of main-line railroads be carefully considered and that definite plans be adopted for encouraging this development. Furthermore, the association should investigate more aggressively opportunities for using electricity in commercial heating and in electrochemical and electrometallurgical operations. The committee also suggested that a new sub-committee be formed to compile data on the development of protective apparatus for transmission lines.

Overhead-Line Construction

No meetings or extensive technical investigations have this year been conducted by the committee on overhead-line construction as was done in previous years, according to the report of the chairman, Mr. Thomas Sproule. It was explained that any detailed work by the committee would not only be futile but might obstruct proper consideration of the more general problems. As might be expected, a number of objections have been raised to the overhead-line construction specifications presented last year, owing to the fact that methods of construction required in one section of the country are necessarily different from those in another. Attention was called to the difficulties which will ensue if all of the line construction reports which are under preparation by different organizations are adopted. Where the

committee on overhead-line construction has co-operated in the preparation of such work, however, the results have in general been satisfactory. It was therefore urged that the association take a decided stand—insisting that its report be accepted or that it be represented on any committee or in any organization issuing rules governing overhead-line construction. In outlining investigations which various organizations are conducting on this subject it was pointed out that the work of the national joint committee has been divided among four sub-committees on structural, insulation, conductor and clearance details, each of which is being investigated very thoroughly. One of the most noteworthy features of the "Safety Rules and Regulations" issued by the United States Bureau of Standards is their classification according to relative hazards. The public significance of the work of the Bureau of Standards has been recognized by the N. E. L. A. in the appointment of its public-policy committee to confer with the bureau.

Distribution Conditions in the Pacific Northwest

Where movements toward specific public regulation of public utilities through the use of N. E. L. A. specifications have touched the question of line construction, Mr. J. C. Martin in his paper contended that the form the specifications have taken has been an embarrassment to companies operating in the Pacific Northwestern States. The paper sets forth a few of the reasons for this embarrassment. Classed as the most important factors to be considered are: (1) The contrast between conditions in the eastern and western sections of the United States; (2) distribution-line conditions and voltages in the East and West; (3) the intended application of the specifications as contrasted with the attempted application of them, and (4) features of the specifications which have embarrassed operators in the Western States.

The West, which is sparsely settled in comparison with the East, finds fuel expensive and electricity necessary. In the West distribution at pressures up to at least 15,000 volts is necessary at the present time. The overhead-line committees in formulating specifications intended these to act as a guide and to be of assistance to the industry, whereas, instead, they are now being used as official by regulatory bodies, and attempts have even been made to write them into state laws. These specifications, which reflect current Eastern practice, are not applicable to Western needs, declared the author. The crossing specifications have been the real point of attack, especially the 500-volt limit clause. From the author's point of view the specifications not only ignore the fact that details applicable to one situation will not fit all situations, but, besides, they neither provide for various grades of construction nor recognize that various grades of construction are necessary to meet various conditions. The specifications, Mr. Martin states, if written into state laws, cannot be readily changed. With the rapid development now taking place in the electrical industry in Northwestern Pacific territory, such restrictions will become a distinct menace, because no allowance is made for the use of more than one grade of construction.

Report of the High-Tension Sub-Committee

The report of the high-tension sub-committee of the hydroelectric committee, of which Mr. R. J. McClelland was chairman, called special attention to the effect which public and semi-public regulations will have on the construction and operation of transmission systems. It was pointed out that regulating bodies which have prescribed specifications for overhead-line construction have failed to recognize the necessity for different construction in localities where the conditions are different. In outlining some of the differences in distribution-line requirements it was pointed out that line construction in densely populated regions should be different from that in sparsely settled districts. In the latter local capital is seldom found to be available for installing local plants, therefore electric service must be furnished by large transmission companies. These companies should not be expected to install the most elaborate equipment, as their return on their investment is usually uncertain. The primary requisite should be inexpensive service rather than continuous service. Attention was called to the opportunity for increasing transmission-line revenues by selling electricity for irrigation pumping. Climatic conditions constitute another factor that should be considered in determining the proper construction which should be used.

High-Tension Apparatus

The sub-committee on high-tension apparatus, Mr. W. N. Ryerson chairman, reported that it had hoped to begin the preparation of a manual covering the installation and operation of all high-tension apparatus, but found that the time available was entirely too short. The committee therefore suggested that a manual covering the installation and operation of high-tension apparatus be prepared, this work to cover everything from low-tension oil switches of transformers to low-tension switches in substations. A number of suggestions were made as to the various lines along which future committees might collect valuable data. Some of these suggestions dealt with the original design of the installation, the committee expressing the opinion that insufficient attention has been paid to the effects of certain features of design upon the operation of plants.

Electrification of Main-Line Railroads

If power could be supplied from a central system serving an extensive territory having diversified power requirements, it would probably hasten the electrification of many railroads, according to Mr. B. F. Woods, chairman of the committee on electrification of main-line railroads. Although railroad corporations may have no great difficulty in securing additional capital for building their own electric generating stations, they will not receive so large a return on their total investment as if energy were purchased. Furthermore, the rating of reserve equipment will have to be a greater proportion of the total rating than for a larger system supplying diversified loads. The generating and distributing equipment owned by one electrified railroad cost so much that the road could have afforded to purchase energy from an electric-service company and still obtained a net return nearly 50 per cent greater than that obtained by developing its own energy. Another point which should be considered by central stations is that if railroads are forced to provide their own generating and distributing facilities, it will be more difficult to convert them to the use of central-station energy later on. The committee expressed the belief that the N. E. L. A. should collect and co-ordinate data pertaining to the electrification of railroads and their operation. If electrification of main-line railroads is to be encouraged, it will be necessary for the association to obtain the active co-operation of railroad officials and engineers. The committee therefore recommended that some changes be made to permit and encourage such membership.

Discussion

Comment on the papers and reports read at the second hydroelectric and third technical session was reserved until all the papers had been presented. The following participated in the group discussion: Messrs. Thomas

Sproule, Philadelphia Electric Company; J. E. Kearns, General Electric Company, Schenectady; Charles O. Poole, Riverside, Cal.; Aug. J. Bowie, San Francisco; J. E. Woodbridge, Sierra & San Francisco Power Company; A. H. Babcock, Southern Pacific Company; Philip Torchio, New York Edison Company; Prof. W. D. Peaslee, Oregon Agricultural College; Harold Goodwin, Jr., Philadelphia Electric Company; J. A. Vahey, Boston Edison Company; L. M. Klauber, San Diego; R. J. McClelland, Electric Bond & Share Company; E. R. Northmore, Los Angeles Gas & Electric Corporation; J. A. Lighthipe, South California Edison Company, and W. C. L. Eglin, Philadelphia Electric Company.

After the reading of the papers and before the meeting was thrown open to discussion Past-president Eglin commented briefly on the work before the association. He pointed out that when the 1911 report on overhead-line construction was prepared it had been essential primarily to establish standards of construction that would be at least creditable to the industry, and that it was not therefore fair to expect too much from the initial effort at standardization. He recommended that there be no endeavor now to compromise with other interests, but rather to establish standards compatible with what appears best from the standpoint of those experienced in the generation and transmission of electricity.

Mr. Klauber pointed out that Western conditions are such that construction can be used there safely which would be unsafe under Eastern conditions. He cited a case near San Diego where a 9-mile line had been built to supply energy to a single 250-hp motor, and pointed out that if expensive constructions were required for service of this kind the consumer would be obliged to do without it. He said that in changing from No. 6 to No. 4 wire over crossings the construction is mechanically weakened, and expressed the opinion that it would be better to run lines straight through on heavy insulators.

Professor Peaslee, who concurred with Mr. Klauber, cited a typical case in which an 1100-volt line run to a town of 1600 inhabitants involved thirty-one crossings, which under the 1911 rules cost the inhabitants $4 per capita more for the service than if the transmission line had been erected without special crossings.

Mr. Goodwin questioned the wisdom of allowing telephone companies to prescribe methods for eliminating interference. He mentioned an instrument which one telephone company has been developing for locating the point at which interference occurs. After the use of this instrument the company had gone so far as to move poles in order that transposition could be made at the right point to avoid interference. Transposition in this case eliminated the trouble.

Mr. Bowie stated that the findings of the Railroad Commission of California were erroneous in requiring oil switches instead of air switches on transmission lines, pointing out that there was less likelihood of interference when the air switch was used. Mr. Woodbridge referred to tests in which oil switches broke the circuit within one-half cycle to three or four cycles, whereas the air switch required from 100 to 2500 cycles, thereby introducing unbalanced conditions by not interrupting the current in all wires simultaneously. In commenting on the findings of the inductive interference committee of the California Railroad Commission, Mr. Babcock said that there was no intention to discriminate against any particular type of switch, but that those who composed the committee were qualified by experience to appreciate the qualities of both the oil and the air type and that their finding was based on an intimate acquaintance with the action of both types.

Mr. Kearns presented a motion, which was adopted, suggesting that the present recommendation of the association be changed to specify that lightning arresters be placed on the same pole with transformers. Another motion from Mr. Kearns, also approved, was to the effect that the sub-committee on high-tension apparatus be instructed to co-operate with the electrical-apparatus committee in preparing any information they intend to publish.

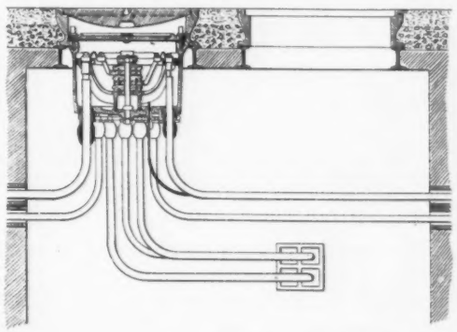
Dr. E. B. Rosa, of the Bureau of Standards, Washington, telegraphed the association as follows:

"Because of unavoidable delay in meeting demand for Circular 54, and to present the fullest opportunity to study and criticise the proposed National Electrical Safety Code, the Washington conference called for July 1 has been postponed to Oct. 27."

Mr. W. C. L. Eglin explained that criticisms of this code should be sent directly to Dr. Rosa, but he urged that duplicate copies be also sent to Mr. McClelland of the association's own committee.

Committee Report on Underground Construction

The report of the committee on underground construction, of which Mr. Philip Torchio was chairman, contained three sections—the first relating to manhole and conduit construction, the second to cable data and protection, and the third to equipment, devices, etc. Reports received from companies owning approximately 75 per cent of the underground equipment in this country show that they have 100,862,587 duct-ft. of subway intended for electric-service conductors. According to the committee report, there exists a greater difference in practice among these companies than appears to be justified. The conclusion was drawn that the cost of a pulling-in system containing no manholes or hand-holes will not be materially different from that of a solid-joint system employing armored cable, and that the former may even prove preferable. To make conditions sanitary for employees to work in manholes some companies have established the practice of cleaning manholes periodically and forcing fresh air into them before allowing men to enter. Where the total rating of transformers installed in a manhole does not exceed 100 kw, the natural heat conduction through the ground is generally sufficient to keep the transformers within safe temperature limits. When the manhole temperature exceeds 120 deg. Fahr., however, artificial ventilation should be provided. For the installation of large units separate manholes are recommended. Attention was called to several precautions which should be observed in operating subway transformers.



MANHOLE JUNCTION BOX FOR LOW-TENSION DISTRIBUTION

When pressures of 10,000 volts or over are used in cable systems, careful consideration should be given to causes of heating, among which are the losses in the conductor and in the dielectric material. Loss due to leakage through a dielectric appears to be greater with some resinous compounds than with some of the mineral oil compounds, and varies greatly with changes in tem-

perature. Attention was called to the fact that the radiation from cables changes according to the season of the year. It was suggested that some scheme for ventilating conduit be devised.

It was pointed out that more energy can be conducted through a duct of given dimensions with sector-conductor cables than with round-conductor cables. The use of protective reactors, the grounding of neutrals, the use of arcing-ground suppressors and the chemical action of cement-mortar coverings on cables were discussed. Owing to the effect of stray currents on cable sheaths protected by asbestos covering, the committee recommended that its use be discontinued, especially in damp places. In comparing various types of surface and manhole boxes many advantages were shown in favor of the former when installed in recesses separate from the manhole. The report was concluded with descriptions of labor-saving and accident-preventing devices.

Grounding Secretaries

The necessity of grounding secondaries was declared to be no longer debatable by the committee on grounding secondaries, of which Mr. Paul Spencer was chairman. All companies are not, however, as yet installing such connections or requiring that they shall be installed by consumers before service will be supplied. This, the committee reported, is not surprising, since many plant operators who believe in grounding have undoubtedly hesitated to put their beliefs into execution because local soils in some cases are unsatisfactory for artificial grounds. Under proper conditions, well-made plate grounds or group driven-pipe grounds have resistances as low as 3 ohms to 5 ohms. In dry, sandy soil, however, the resistance of single driven-pipe grounds may be hundreds or even thousands of ohms. Attention was called to the fact that the importance of installing grounds on alternating-current secondary systems is becoming generally recognized by municipal authorities and regulatory bodies. According to extracts which were quoted from the grounding rules made by different public-service commissions, most of these bodies have adopted the National Electrical Code requirements or rules very similar to those contained therein. In Illinois and New Jersey the public-utility companies are required to adopt plans whereby existing construction can be made to conform with the rules.

The National Electrical Safety Code was referred to as containing definite recommendations on the subject of grounding. Since criticisms of the rules contained therein have been invited by the Bureau of Standards, it was suggested by the committee that compliance with the request be made as promptly as possible through members of the N. E. L. A. who belong to the national joint committee.

Discussion

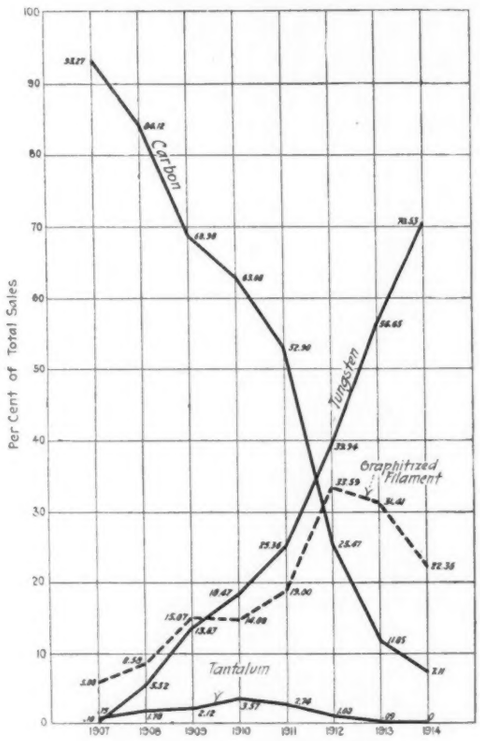
The report of the committee on grounding secondaries was discussed by Messrs. J. A. Vahey, Edison Electric Illuminating Company, Boston; I. A. Rosok, Bisbee (Ariz.) Improvement Company, and J. C. Martin, Pacific Power & Light Company, Portland, Ore.

Mr. Rosok cited the case of the Bisbee Improvement Company, which is not allowed to use the water pipes for grounding but which has operated a two-phase, 800-kw system with 20 miles of primary and 40 miles of secondary line for fifteen years, without any accident attributable to this cause. He said he was sure the maintenance is much less on a system with no secondary grounds. Mr. Martin stated that the Pacific Power & Light Company sometimes faced the practical impossibility of getting good grounds, and he suggested further study of such conditions.

LAMPS AND ILLUMINATION

Report of the Lamp Committee

The disturbed condition of the country has had its effect upon the lamp business, and during the year 1914, according to the report of the lamp committee, of which Mr. Frank W. Smith was chairman, the aggregate sales of domestic incandescent lamps, exclusive of miniature units, totaled slightly under 100,000,000, which was the output for the preceding year, 1913. The 1913 sales represented an increase of about 11 per cent over 1912. Sales of tungsten lamps now amount to 70 per cent of the total domestic lamp sales, or about two and one-third times the output of all other lamps combined. The tantalum lamp has disappeared from the market.



SALES OF INCANDESCENT LAMPS

The bulk of the tungsten multiple lamps are now sold in the 25-watt, 40-watt and 60-watt sizes, the percentages for 1914 being: 10-watt lamps, 5.26 per cent; 15-watt, 5.89 per cent; 25-watt, 27.66 per cent; 40-watt, 27.19 per cent; 60-watt, 17.27 per cent, and 100-watt, 6 per cent. The average size of the lamps sold during 1914 was 38.2 cp and 48 watts, making the average output 0.8 cp per watt. Of the miniature lamps now manufactured, at least 85 per cent are tungsten units.

Nearly 1,000,000 gas-filled lamps were sold during 1914. Improvements in these lamps have been along the line of securing a more uniform product. The principal change in design has been to adopt a new line of bulbs in standard sizes. The new bulbs are pear-shaped with extended glass necks. It is customary to insert a mica disk deflector between the stem and filament of these lamps, thereby deflecting hot gases from the glass seals and base. Usually these lamps are constructed for but one position of burning, namely, tip-down. Manufacturers can, however, supply lamps designed for operation tip-up, but such lamps must be ordered specially for this purpose.

The improvements in vacuum lamps during the last year are noticeable principally in increased efficiency. Since last year's report this improvement has been in the neighborhood of from 7 to 10 per cent in sizes below 150 watts. The practice of introducing chemicals to delay the discoloration of the bulb has been extended to include 10-watt, 15-watt and 20-watt lamps and has permitted the operation of all vacuum lamps at higher efficiencies with improved maintained candle-power.

According to the committee, inferior tungsten-filament lamps, of both the vacuum and gas-filled types, are making their appearance on the market in increasing numbers. It is, however, possible for the central station to supervise the supply of lamps to its customers in such a way that they may be assured of obtaining only good and properly rated lamps. Members are accomplishing this successfully by methods which range from the sale of lamps at list prices under such vigorous merchandising activity that practically all customers purchase lamps from the central station to the other extreme of free lamp renewals as a part of the lighting service.

Among arc lamps the principal development noted in the report has been the perfection of the higher efficiency magnetite electrodes and the provision of a new 5-amp system to supplement the former 4-amp and 6.5-amp systems.

Discussion

The report of the lamp committee was discussed by Messrs. Clarence L. Law, New York Edison Company; John W. Howell, General Electric Company; John F. Gilchrist, Chicago; Samuel E. Doane, National Lamp Works, Cleveland; Lawrence A. Coleman, United Electric Light & Power Company, New York; W. H. Rollinson, Westinghouse Lamp Company; Preston S. Millar, Electrical Testing Laboratories; Douglass Burnett, Baltimore, and Theodore I. Jones, Brooklyn.

Mr. Law gave data on tests of incandescent lamps in a show window, the lamps having a color value closely approximating daylight. He presented three autochrome slides of a window, one lighted with blue lamps, one with white, and one with blue lamps and white lamps staggered. Mr. Howell stated that the life of the gas-filled lamps is now considerably in excess of the guarantee. Customers should be supplied with lamps sold on specifications and subject to test. Buying on specification and subject to test is the greatest incentive to the manufacturers to improve their product. The United States government buys all its lamps that way, and its specifications are not so close as those of some of the large lighting companies. This method is available to the small companies.

Mr. Gilchrist deplored the tendency of the managers of small plants to give the customers immediately all the advantages that come from the use of improved illuminants without getting any advantage or even credit for their companies. Representatives of manufacturers are active in promoting this attitude, but the managers should not fall in with such suggestions too readily, as it deprives them of an asset which they may need in future dealings with the public or official bodies.

Mr. Doane referred to a modification made in the construction of the holder of the gas-filled lamp. In Europe signs have been plastered all along the roads inviting the public to save 70 per cent of their light bills at the expense of the producers of electricity. Nothing like that has been fostered by the manufacturers here. If they had maintained the candle-power basis of rating, there would have been an added dropping off in the rating each man would have asked for in making substitutions of the improved for the old lamps.

Mr. Coleman stated that the 1000-watt gas-filled lamps lighting New York streets are satisfactory in saving the expense for inspection and maintenance incidental to the use of the arc lamps which they supplanted. The city of New York is negotiating for 200-watt lamps for use in side streets and for gas-lamp replacements. On May 1 the company filed a rate schedule abolishing free renewals and offering a 0.5 cent per kilowatt-hour extra charge for renewals.

Mr. Rollinson presented slides showing the candle-power characteristics of the gas-filled lamp. He displayed a distribution curve illustrating the difference between a regular lamp and another lamp giving the maximum light in a downward direction. The latter lamp has no greater efficiency and its life is shorter than that of the regular type, its advantages being entirely in the light distribution and color.

Mr. Millar stated that tests in service and in the Electrical Testing Laboratories showed that no one need apprehend difficulty from the performance of the large gas-filled lamps. He said that the pendent burning position is a present regrettable limitation to the flexibility so necessary for the success of the incandescent lamp, which it is hoped engineers may be able to overcome. The blue bulb costs about twice as much as the standard clear-glass lamps, and it does not appear to have a large field except as a novelty. The light content in the blue part of the spectrum for the blue-bulb lamp is about half way between the ordinary tungsten-lamp light and average daylight. New York is flooded with inferior lamps, and there are many on the Pacific Coast. Their use will increase unless central stations control the supply.

Mr. Burnett discussed lamp service as affected by methods of labeling lamps. The use of long feeders in suburban and rural districts requires different voltages. Instead of having the present variation up to 125 volts, which is so satisfactory to manufacturers, it would be well to promote the standardization of 110-volt, 115-volt and 135-volt types, designated by differently colored labels. It would be easier to educate dealers and the public to call for a red-label lamp than for a 115-volt lamp.

Mr. Jones said that the 1000-watt gas-filled lamp had been taken up in Brooklyn as a commercial bonanza and was used to replace gas lamps. The life of the lamp was not satisfactory and, although the manufacturer "made good" under the guarantee, the labor expense of renewal caused the company to slacken its campaign until experience showed that a satisfactory life had been established. The Edison Electric Illuminating Company of Brooklyn suffered from the action of a representative who went to work to show the city how to cut down the company's revenue by replacing the 500-watt direct-current arc lamps with 300-watt incandescent lamps; but as the company is obtaining a life of from 2000 to 2500 hours per lamp, instead of the expected 1000, with no expense for trimming, no loss is anticipated. The principal trouble with the lamps has been caused by the heat rising up to the base. A solution would be found if the lamp could be reversed in position.

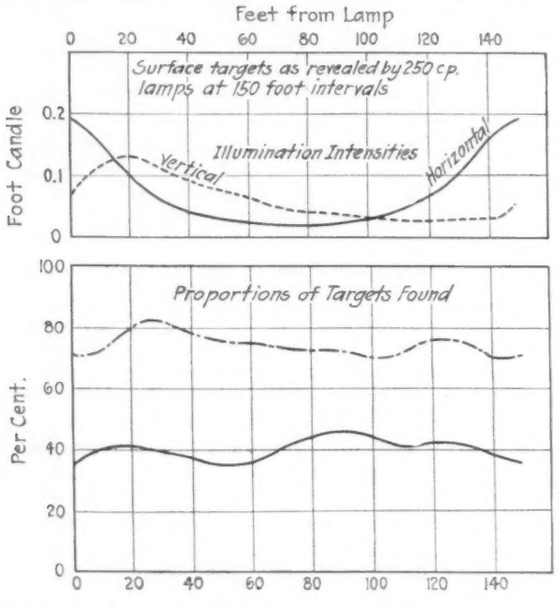
Mr. Jones said that the free renewal of lamps in large units to commercial customers has proved successful.

Street-Illumination Tests

The report of the committee on street lighting, of which Mr. John W. Lieb was chairman, contained a digest of information made available through actual street-illumination tests in New York City; data on the characteristics of flame-arc, magnetite-arc and gas-filled incandescent lamps, and statements regarding manufacturers' development policies. The results of the tests which have been completed are of value principally in indicating, for a particular street, the effect of varying the height and spacing of lamps, and in affording in-

formation concerning relative merits of large and small illuminants for street-lighting purposes.

With small lamps installed over curb lines light is transmitted to any point in the street from several directions; therefore, objects are not as readily discernible as when sharp contrasts are obtained. When the test street was illuminated in this way it appeared wider than when lighted by several centrally mounted lamps; but, it was reported, opinions differed regarding the relative appearance of streets lighted by the two systems. Moreover, it was found that objects placed in the streets could be discerned more readily when the lamps were arranged in a single line along the street than when light was radiated from several sources on each side. It was observed that the visibility of surface targets did not necessarily depend on intensity of illumination. This was accounted for by the fact that objects are most readily discerned when there is a sharp contrast between them and the background. From observations made with lamps mounted at different heights and distances apart, it was found that objects could be seen most clearly when the lamps were 18 ft. above the street level. With the lamp at this height, however, it was the unanimous opinion of all observers that the street did not have so good an appearance and that the illumination was not so agreeable or comfortable as when the lamps were mounted 24 ft. high. With lamps mounted centrally over a street at a given height, and spaced to yield equivalent light flux per linear foot of street, it was found that small lamps arranged from 150 ft. to 225 ft. apart were most favorable. Tests of two radically different forms of light distributers led to the conclusion that while excessive brightness of a light source may only slightly reduce the ability to see objects, the unpleasant appearance and discomfort caused thereby are very objectionable. The committee reported that



RELATION OF PROPORTIONS OF TARGETS FOUND TO ILLUMINATION INTENSITIES

the study of lamp locations cannot be considered as having been covered thoroughly until the effect of different physical surroundings has been taken into consideration.

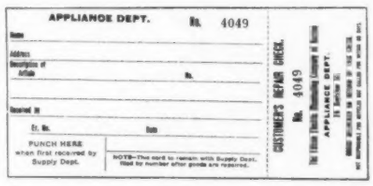
Discussion

This report was discussed by Mr. F. C. Piatt of the Pacific Gas & Electric Company, San Francisco, who presented a formula for determining the cost of street-lighting service under varying conditions of light-unit spacing and arrangements.

SALES AND UTILIZATION

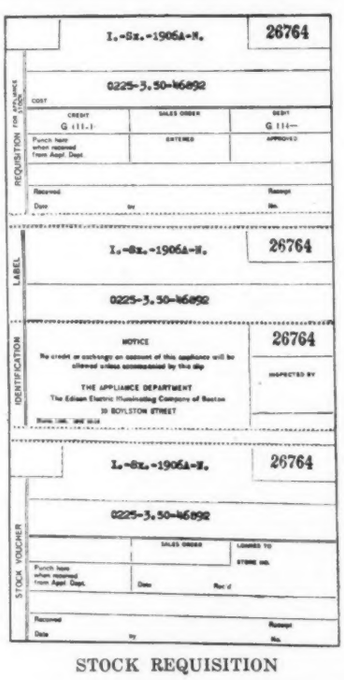
Merchandising

The committee on merchandising and recent developments in electrical appliances, of which Mr. R. R. Young was chairman, presented a valuable report pointing out in detail the basic principles which should be observed in selling electrical appliances. The report covered the



COPY OF REPAIR SLIP AND CUSTOMER'S STUB

following subjects: Merchandising, advertising, show-window and interior displays, requirements of the selling force, industrial-appliance business, recent and contemplated developments in electrical appliances, central-station suggestions on improvements which are needed, apparatus available for various industries, directory of manufacturers, stockroom routine, a perpetual inventory system, and a bibliography. Under merchandising were offered some excellent suggestions on methods of analyzing a market, creating a demand, and handling retail sales and campaigns, as well as on methods of purchasing stock. The need of educational advertising was touched on and the value of co-operative advertising by manufacturers and central stations pointed out. The theory and practical handling of merchandise displays



STOCK REQUISITION

in windows and inside of stores were treated in detail. Valuable hints were given on educating salespeople to present their company's policies and to work for volume of sales rather than unit-sales profit. Special attention was called to methods of developing the industrial-appliance business.

ANALYZING THE MARKET

To sell the largest number of electrical appliances with the least expense, it is necessary to analyze the

market in three ways—financially, psychologically and physically. The general public may be divided into three classes: (1) Those who do not consider electric appliances as household necessities because their work is done by servants; (2) families with average incomes, the women in which could be assisted considerably by electrical appliances—this group offers the greatest field for canvassing, and (3) households in which electricity is considered a luxury and to which monthly bills of $1 or $1.50 are big items—householders in this class appreciate the value of electric appliances but cannot afford to purchase or operate them. The percentage of the whole population falling in each of these groups differs in every locality; therefore the proportions should be estimated to give a basis for making purchases, planning campaigns, and determining the amount which should be spent in exploiting any product.

Assuming that the financial classification has been made, it is next necessary to know how the information can be utilized. Electrical goods are manufactured to appeal particularly to one of the three groups, therefore purchases should be based on the proportion which the interested class will bear to the whole population. For example, assume a community in which 10 per cent of the population belong to the first class, 50 per cent to the second and 40 per cent to the third, then it will be unwise to devote 75 per cent of the sales efforts in endeavoring to reach the first group when there are five times the people in the second group that there are in the first. Considering a case where the store manager has $5,000 to spend on three grades of portable lamps selling for $75, $15 and $5 respectively, it would be advisable to spend about $500 for the expensive line, $2,500 for the intermediate grade and $2,000 for the third line.

PSYCHOLOGICAL CLASSIFICATION

A knowledge of the type of woman representing the average in each class is particularly valuable in making up advertising appeals, in designing general effects for display rooms, in deciding on the material to keep in stock, and in employing salespeople who can best handle the trade. Sometimes it may be advisable to base the sales efforts on the nationality of the customers who are to be interested. Considerable information regarding the best method of interesting people in electrical appliances can be obtained by interviewing representative women and getting data regarding the use of household labor-saving devices, the size of the family, number of servants, stores patronized, social connections, occupation and the number of wage-earners in the family. The types of stores at which prospective customers trade are particularly valuable to know, as a study of the merchants' methods will help in formulating sales campaigns among the corresponding customers. For example, exclusive shops appeal to their customers by offering articles for sale which are not in common use, while middle-class stores base their selling arguments on the general utility of their products.

By studying the mental attitude of prospective customers it is possible to learn which people will search for a store handling articles they desire, which people know their wants but do not know how they can be supplied, and which people go from store to store, "window shopping," so to speak, with no particular concrete desires. In selling to the first and second classes a clerk is usually only an order taker. In dealing with the last class, however, real salesmanship must be shown.

PHYSICAL ANALYSIS

To avoid duplication of effort it is necessary to know what appliances are on the lines and who owns them. One way of obtaining this information is to make house-to-house canvasses and record the kind of devices in use, when and from whom they were purchased, and at what price. By knowing who sold the majority of devices in different localities, appliance sales managers will know with whom to co-operate. Knowledge of the prices paid will be valuable in preparing price schedules. The last information is of particular value in small places where customers are in the habit of making their purchases in nearby cities.

To keep the physical analysis as nearly up to date as possible, records should be kept of appliances sold or placed on trial, along with the names of other appliances in which each purchaser is interested. These cards should be filed by streets, and as people move or discontinue the use of electricity the corresponding cards can be transferred to a separate file. This information may be of value if the customers ever resume the use of electricity. All sales campaigns and sales expenditures should be based on the saturation of the territory as shown by these cards. It will usually be found that owners of electric flatirons may be easily induced to use other appliances.

Discussion

The report of the committee on merchandising was discussed by Messrs. C. N. Stannard, Denver; W. W. Briggs, San Francisco; M. O. Dell Plain, Syracuse, N. Y.; H. O. Loebell, New York, and O. R. Hogue, Chicago.

Mr. Stannard indorsed the use of card systems with complete records of prospective customers and appliances. The temporary discontinuance of salesmen's meetings had proved to his company that such meetings are very valuable for instilling enthusiasm. He favored paying the men good salaries, and suggested the possibility of adding to their salaries a percentage of the increased gross revenue in their districts. This plan makes the men more interested in selling the devices that use much energy rather than devices that are high in first cost but poor consumers of energy.

Mr. Briggs expressed the opinion that it is undesirable to make any reference to cut prices for energy. Central stations should endeavor to co-operate with the contractors and dealers to maintain fair prices.

Mr. Dell Plain said that he knew the committee is also opposed to cut prices even if it does not emphasize that fact in its report.

Mr. Loebell declared his belief that there are greater possibilities for electricity to-day than when it was first applied. Industrial heating offers one of the greatest fields. New methods of refining will eliminate fuel oil in a few years. Even while fuel oil is very cheap, its use is so inefficient that its advantage in cost might be offset by the superior efficiency of electricity. Mr. Hogue said that in Chicago during a sixty-day campaign, when 12,000 flatirons were put out, one out of every three customers called upon was found to be a user. He suggested the continuance of the committee or the formation of a permanent data bureau.

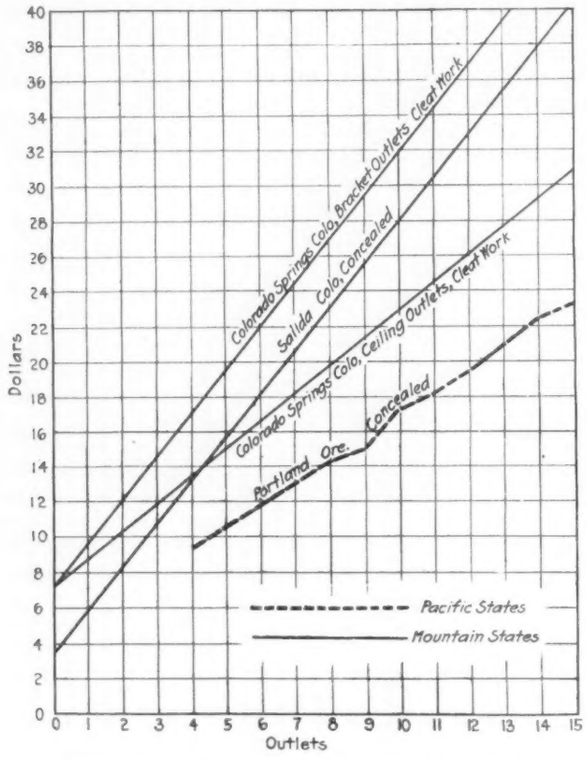
Mr. Young said that the reference by the committee to cut prices was meant only in connection with special campaigns and not as a regular feature.

Wiring of Existing Buildings

The report of the committee on the wiring of existing buildings, Mr. R. S. Hale chairman, included references to the subjects of standardizing plugs and receptacles, cost of wiring, the handbook, standardization of screw threads for lamp bases, the National Electrical Code, bare concentric wire, and flat-wiring rates. The committee expressed hope that inspectors would not discourage the use of receptacles by requiring separate circuit switches and pilot lamps to be installed where receptacles are used. Progress on the standardization of plugs and receptacles was reported, although patent,

commercial and engineering difficulties are involved. A committee of the American Society of Mechanical Engineers, having under consideration the standardization of screw threads for lamp bases, adopted, with some minor changes, the standards already in use by Class D members, as these standards appear to be satisfactory to manufacturers.

In view of the numerous changes that would be necessary in the National Electrical Code to cover the use of concentric wire, the committee decided to continue further investigation and to study trial installations with a view to getting practical experience before recommending changes in the code. The committee declared itself in favor of the unit-price system for wiring, as



HOUSE-WIRING PRICES IN COLORADO AND OREGON

this plan enables central-station salesmen to close contracts for both wiring and service, but did not think it wise to attempt to establish standards, since wiring costs naturally vary with localities and conditions. A number of tables and curves were given, showing the flat-wiring rates that have been adopted by a number of central stations with a view to reducing overhead charges by eliminating the cost of detailed estimating. This material is grouped according to geographical districts, owing to the widely varying conditions prevailing in the country. One diagram is reproduced herewith.

Discussion

The report of the committee on wiring was discussed by Messrs. Samuel E. Doane, National Lamp Works; H. R. Sargent, General Electric Company; E. W. Lloyd, Chicago; T. Ziegler, Oakland, Cal., and S. E. Gamble, Petaluma, Cal.

Mr. Doane mentioned the difficulty encountered in getting manufacturers to agree so that the committee could recommend one type of plug or receptacle. The committee has done excellent work toward an ultimate agreement on this. In regard to concentric wiring, Mr. Sargent said that the General Electric Company will meet the demand of the operating companies, but is not trying to force the wiring upon them. It is now making tools and dies for fittings whereby concentric wiring can be installed easily. The fittings will be finished in three months and available for trial installations which inspectors will probably permit. Great progress will be made during the next twelve months toward universal plug standardization. Two types may be evolved—the "rock-off" and the "straight-pull," and the fitter will survive.

Mr. Lloyd expressed the opinion that concentric wiring is one of the most important subjects before the convention. The time is coming when it will be difficult to serve the small consumer unless cheap wiring is developed. There is no desire to develop cheap wiring at the expense of safety, but the trend toward the use of electricity in small buildings demands the use of inexpensive meters as well as inexpensive wiring. It is desirable to avoid the expense of meter reading. The Commonwealth Edison Company found it easy to make fittings for an experimental installation, and equipped a six-room house at a cost considerably below that of existing approved methods. It is working with the Underwriters and city inspectors with the idea of developing a new system. The company considers concentric wiring of vital importance. The small company must depend for increase in revenue upon the development of a cooking-utensil load, a fact which emphasizes the importance of the standardization of plugs.

The Electric Vehicle and the Central Station

The paper on electric vehicles by Messrs. John F. Gilchrist and Albert J. Marshall was divided into a number of sections presenting a compilation of original and republished material on types of central-station vehicles, data on operating costs and notes on garaging, the value of the electric-vehicle charging load and its relative importance compared with other loads, the possible electric-vehicle market and income to central stations in small cities, the securing of electric-vehicle business, use of electric-vehicle bureaus, etc., closing with an "electric-vehicle creed."

Unmatched by any competing form of transportation, the electric-truck fleets now in operation were declared to represent an investment exceeding $10,000,000, the brewing industry, the department stores and the central stations leading all other classes as electric-truck users. The central station, however, can still further assist the sale and use of electric vehicles in two ways—first, by using them, and, second, by advocating and otherwise promoting their use by others.

By using electric vehicles for its own work the central station not only performs that work satisfactorily, but in addition lends material aid in the further adoption of this modern method of transportation by the public. Central stations can use both passenger and commercial vehicles, and types of each are available to meet every need of the average utility company's work. To put it bluntly, according to the authors, probably the greatest obstacle to the general use of the electric vehicle by central stations has been the "joy-riding" element, which in many instances, by favoring gasoline cars for personal reasons, has caused the electric vehicle to be discriminated against. It is an unpleasant fact to record that a majority of central-station employees are grossly ignorant of the merits and capabilities of the electric vehicle. Their unfavorable attitude, not to mention destructive opposition, is greatly retarding the development of the electric car. Were the central stations using their full quota of "electrics," the number required would equal the total now in use, variously estimated at from 50,000 to 70,000. Central stations should "electrify" their entire transportation equipment with the least possible delay, declared the authors, and should see that it is kept exclusively electric in the future.

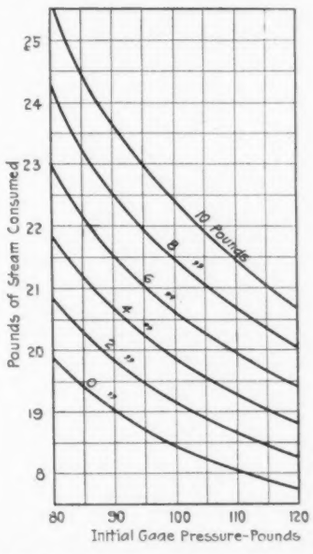
Data on the cost of operating electric vehicles, furnished by the operating records committee of the Electric Vehicle Association of America, Mr. William P. Kennedy chairman, for the electric-vehicle section of the N. E. L. A. Handbook, was reproduced very fully in the appendix to the paper. Material was also presented from the report of the N. E. L. A. committee on high load-factor and non-peak business presented at the 1914 convention at Philadelphia, from Mr. H. W. Hillman's 1913 E. V. A. paper on the value of the vehicle, charging load, and from Mr. S. G. Thompson's paper on the electric vehicle's relation to the business of the small central station, presented last fall before the Newark (N. J.) Section of the N. E. L. A.

The active and aggressive electric-vehicle development work carried on by the Commonwealth Edison Company and the New York Edison Company was reviewed in detail, and the paper was concluded with the following impressive "Electric-Vehicle Creed," to which were appended the signatures of many executives and officials prominent in the utility field:

"We believe in the electric vehicle—that the electric vehicle is destined to supersede other forms of transportation methods, at least for city and suburban work; that the electric vehicle merits the full and hearty recognition and co-operation of the central station and other electrical interests *now*, in order that the electric vehicle may come to its own with all possible speed; that the future development of the electric vehicle presents highly profitable new business for the central station. We believe in the policy of central stations using, wherever possible, electric vehicles; likewise in advocating and generally otherwise promoting their general use."

Demonstrating a Sale of Central-Station Motor Service

In the paper by Mr. C. H. Stevens entitled "Demonstration of a Power Sale" the author gave an analysis of a typical course pursued by representatives of the Edison Electric Illuminating Company of Brooklyn in inducing an industrial concern to use electric motors and central-station energy. The first part of the paper contained a description of the organization and equipment required to handle this work. Then followed an



EFFECT OF BACK PRESSURE ON ENGINE ECONOMY

outline of the methods of securing "leads" and of subsequently obtaining permission from the owners or architects of the plant to conduct tests. Samples of reports prepared from the tests to show the comparative expenses when operating with central-station energy and with a private plant, and the conclusions to be drawn, were also presented. It was then explained how objections to conclusions in the report can be met immediately with a definite answer, and arguments were presented which usually induce a wavering prospective consumer to consent at least to try central-station service. Among items which were cited as usually the cause of considerable argument were initial cost of equipment, rates of depreciation, obsolescence, taxation and insurance, cost of heating, boiler and engine performances, inclusion of expense of supervision and rental value of floor space in operating cost of private plant, etc. In order to have a firm stand from which to reply to these objections, the salesmen are furnished with data which have been compiled from actual installations. In conclusion, the author pointed out that the success which is met in negotiating a contract will depend to a great extent on the manner in which the arguments are presented, or, in other words, on the personality of the salesman.

Discussion

The paper on motor-service sales methods was discussed by Messrs. Ross B. Mateer, Riverside, Cal.; M. O. Dell Plain, Syracuse, N. Y.; M. C. Osborn, Spokane, Wash.; J. G. Learned, Chicago; R. Lewis Lloyd, Philadelphia; C. N. Stannard, Denver, Col.; Robert H. Knowlton, United Gas Improvement Company, Philadelphia; T. I. Jones, Brooklyn, N. Y.; S. V. Walton, San Francisco; C. A. Littlefield, New York; S. M. Kennedy, Los Angeles; J. H. McDougall, San Francisco; E. B. Waltham, Fresno; Douglass Burnett, Baltimore; H. P. Pitts, San Francisco; A. W. Childs, Los Angeles; E. B. Criddle, Riverside, and L. M. Klauber, San Diego, Cal. Nearly every speaker emphasized the necessity of choosing salesmen and training them primarily for the development of their selling abilities, and expressed the difficulty experienced in finding engineers who can keep constantly in mind the point of getting the contract signed and work tactfully toward this end. Mr. Learned brought out the point that it is unnecessary for a company to put itself on the defensive by claiming that it can save money for a consumer, and Mr. Kennedy showed that the greatest savings companies make for consumers are in the elimination of trouble, shutdowns, etc., which give the industrial plants they serve a continuous production. A prospective customer can make a larger return on the cost of an isolated plant by investing the sum in his own business and thereby avoid the annoyance and drain upon his time of managing his power plant, and this argument has proved convincing in the experience of many delegates. The importance of the salesmen becaming familiar with the production end of the prospective customer's business and winning his confidence by suggestions which will help him aside from the electric proposition were mentioned by several. The outlook in regard to Diesel oil-engine competition is engaging the attention of Western operators. Obstacles interposed by consulting engineers working on a commission basis seem to be more apparent in the East than in the West. In the West the manufacturers have become so converted to electricity that it is not difficult to get electric service into a new enterprise, but a high class of salesmanship is required to displace an existing plant used in an old business. Gold dredging and some other large industries around San Francisco could hardly operate without electricity, an established fact which facilitates sales.

Mr. M. C. Osborn, Spokane, said that when he got tired of hearing his colleagues in the Industrial Bureau of the Chamber of Commerce complain of the high cost of electric motor service, he made investigations and found that the average cost of energy in the total pro-

duction cost of an article was about 2.0 per cent. The highest was 4.0 per cent and the lowest 0.2 per cent. In old flour mills using line shaft with 100-hp to 200-hp motors, working one shift, energy costs 5.5 cents per barrel of flour. In new plants with individual motors having roller bearings two mills are producing flour at a cost for electricity of less than 3 cents per barrel.

Power Sales Bureau

The report of the power sales bureau, of which Mr. C. J. Russell was chairman, contained an outline of the bureau's organization, explained relations with co-operating organizations, and pointed out that the sub-committee on statistics and data is standardizing forms on which information regarding motor applications will be recorded. A clearing house for all information collected by this committee will be established at the headquarters of the Commercial Section in New York City.

Discussion

The report was discussed by Messrs. J. G. Learned, Chicago; R. H. Knowlton, Philadelphia, and Douglass Burnett, Baltimore. Mr. Learned commented on the manufacturing and power data form which accompanied the report, stating that he considered an 8.5 in. by 11 in. standard letter sheet best because it can be filed in the records of the company. Not only must the agent secure the information, but this information should also be placed in the records of the company, so that the inquiry need not be repeated later. Mr. Knowlton said that the form presented had been selected because it would fit into the "Salesman's Handbook." Mr. Burnett stated that the Consolidated Gas, Electric Light & Power Company of Baltimore had recently adopted a schedule of industrial gas rates, particularly where it would supersede steam and leave the rest of the applications open for electricity. Within the past year the Baltimore company increased its electrical load-factor from 26 to 52 per cent, and it hoped to accomplish like results in the gas field.

Typical Power Sales Development in the West

The committee on typical power sales development in the West, Mr. J. H. McDougal chairman, in its report declared that there are few, if indeed any, motor-service installations that are peculiar to the West alone.

However, in making selections from the large amount of material collected many recent installations of classes of business which are perhaps most fully developed in the West have been described. Gold dredging, mining and milling, and copper mining and smelting naturally get a good share of attention, but such unusual motor business as giant-powder and rubber manufacturing, sugar refining and wireless telegraphy are also referred to. The points of interest in each installation are emphasized, and while the data alone are of tremendous value, it is the belief of the committee that the most far-reaching result of the report will be in suggesting new lines of business to be followed up.

For gold dredging variable-speed reversible motors are used for driving the endless-chain digging buckets, the same motor often operating the ladder hoist-winch, while swing winches are operated by the same type of motor. Constant or adjustable-speed motors are used on screens and stackers. Electricity is used extensively in gold mining and milling. A complete motor equipment of a gold mining and milling establishment in Nevada utilizing 200 hp in motors was described in the report. Electricity also finds extensive use in copper mining and smelting. Stone and granite quarries were visited by the committee, and data on motor installations obtained. Near the Sacramento and San Joaquin Rivers and their tributaries about 1,725,000 acres are subjected to overflow in the winter. Much of this land is now being recovered, for, since it is largely composed of decayed vegetable matter and silt from the rivers, it forms a most productive soil. About 11,050 hp in electric motors is at present used for reclamation purposes in this district. The subject of irrigation was also discussed comprehensively in the report. In California, for example, there are about 20,000,000 acres of arable land, the greater part of which it is possible to irrigate. Electric pumps are extensively used in California for irrigation purposes, the load curve for eleven plants showing a yearly load-factor of 61.1 per cent. Mention was also made in the report of city water supply systems, city sewage pumping, suction dredging, and a number of other commercial applications of electricity.

The report of the power sales committees was discussed by Messrs. C. H. Stevens, Brooklyn; Robert H. Knowlton, Philadelphia; C. I. Weaver, Jackson, Mich.; J. G. Learned, Chicago, and S. M. Kennedy, Los Angeles.

Commercial Applications of Resistance Furnaces

In the paper by Mr. C. W. Bartlett, the author divided commercial applications of electric resistance furnaces into four classes, each having a definite temperature range. The limits of temperature and a few of the typical operations specified in each class are as follows:

Class 1.—From 1000 deg. to 1400 deg. C.: (a) Hardening high-speed steel; (b) heating steel bars for forging and welding; (c) melting copper and gold.

Class 2.—From 450 deg. to 1000 deg. C.: (a) Annealing; (b) heating copper, brass and Monel forging bars; (c) melting zinc, silver and aluminum.

Class 3.—From 250 deg. to 450 deg. C.: (a) Sherardizing; (b) melting tin, lead and babbitt; (c) boiling varnishes.

Class 4.—From 100 deg. to 250 deg. C.: (a) Baking japan, enamels, lacquers and insulating compounds; (b) vulcanizing; (c) heating molds.

In discussing the applications under the first two classes, the author described in detail the construction, equipment and operation of a carbon-resistance type of furnace. The heating chamber of such a furnace is equipped with a main and an auxiliary resistor, both of carbon. With the furnace doors closed, the carbon resistors when heated to operating temperature eliminate the oxygen from the furnace atmosphere and thus by controlling the ventilation of this chamber either a reducing, neutral or oxidizing atmosphere may be obtained as desired for the process in question. Practically constant operating temperature is automatically maintained by taking advantage of the negative temperature coefficient of the resistors. Change of current with change of temperature alternately connects the furnace to a half-voltage and a full-voltage circuit.

A number of resistance furnaces designed for particular processes were also fully described, and tabulated data were presented showing an analysis of the atmosphere in the heating chambers and the amount of energy consumed for specified outputs. Emphasis was placed on the necessity of selecting a furnace of the proper dimensions and kilowatt capacity for a specific work, and on the fact that operation at a cost to be favorable compared with that of oil or gas furnaces depends entirely upon obtaining a comparatively high thermal efficiency. Many of the advantages which characterize the electric furnace are pointed out—among them freedom from overheating, absence of danger of explosion, decreased loss of heat, simplicity of apparatus, and marked improvement in quality of product.

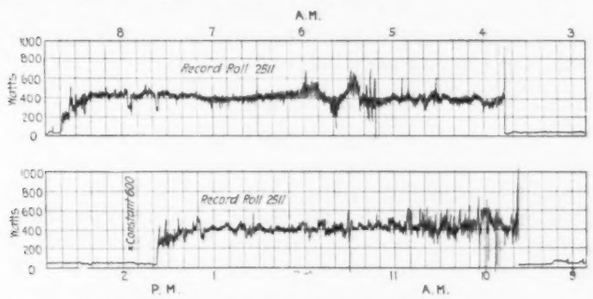
The paper pointed out definitely the opportunities which electric furnaces offer as desirable new-load builders for central stations. Based on rough esti-

mates, a possible revenue of about $15,000,000 per annum is shown to be easily obtainable from this class of load if carefully cultivated by the central-station industry.

Stassano Arc-Furnace Operation at Redondo, Cal.

Mr. W. M. McKnight described the first Stassano electric-furnace installation in the United States, which is at Redondo, Cal. A 1-ton furnace of this type has been operated twenty-four hours per day continuously since its installation in November, 1913, except for three two-day intervals during each month, necessary for re-lining. The furnace produces steel castings which are homogeneous and of good grain, and hence reliable where the greatest strength is required. At present automobile fittings, gears, propellers, rocker arms and waterwheel buckets are being manufactured in sizes ranging from the smallest to huge pieces weighing 1600 lb. each.

The distinguishing feature of the Stassano furnace is that fusion is obtained by radiant heat from a three-phase electric arc at a distance of 2 in. to 3 in. above the metal and approximately 24 in. from the roof of the



VARIATIONS IN STASSANO FURNACE LOAD

furnace. The operation goes on in a closed chamber with a neutral atmosphere for the chemical reactions which take place in the process of refining. The author describes the methods of suspension, tilting, metering and switch protection in detail, and gives a full description of the electrodes, their size, location, and water-cooling system. The current consumption of the furnace is from 800 amp to 2000 amp per terminal on a three-phase, 150-volt circuit, which is supplied through transformers from a 10,000-volt transmission line. The load variation from day to day is slight, the average demand being about 225 kw.

Electric-Furnace Power Loads

The paper presented by Mr. F. T. Snyder on "Electric Furnace Power Loads" emphasized the fact that this application of electric energy is entering upon a period of rapid growth and should receive serious consideration from power producers. At present about 1,000,000 hp is used in electric furnaces throughout the world in the aluminum, carbide and nitrogen industries, and in the making of steel alloys and special chemical products. The energy used in the first group is largely produced directly by the users, but that used in the second is generally purchased from power companies and is of special interest here. How rapidly this load will develop and what proportion of it will be purchased from central stations will depend largely on the attitude and policies of the companies. The size of the power loads demanded in the steel-melting business, in the production of certain steel alloys, and in high-temperature chemical processes makes possible a low rate and therefore lower production costs than attainable with fuel furnaces.

The character of electric furnace loads is well suited for central-station service. In actual experience electric furnaces show an annual load-factor on twelve-hour service of about 40 per cent and about 70 per cent with twenty-four-hour service. Practically all large electric furnaces can be shut down from two to four hours at the time of peak load without serious loss of temperature.

Most of the regularly operating furnaces are now single-phase, and the proportion is steadily growing in the face of almost universal three-phase generation and transmission. The energy loss, the bulk of which occurs in the electrodes and contacts, the refractory and electrode consumption—largely a matter of surface burning—and the labor required per ton of output are roughly proportional to the number of electrodes used. This makes the cost of operating a three-electrode furnace much higher than the cost with a single-electrode furnace, and this difference will eventually force all electric furnaces to a single-phase basis. The single-electrode furnace also makes a much more uniform load than does the three-electrode type. Since the commercial advantages of single-phase furnaces are so great the power companies, declared the author, must facilitate the use of this furnace load by arranging to supply single-phase service.

Discussion

The three papers on electric-furnace topics were discussed by Messrs. J. Kearns, Henry O. Loebell, New York; M. O. Dell Plain, Syracuse, and F. T. Snyder, Chicago. Mr. Kearns, in referring to Mr. Snyder's paper, said that it is not a question of single-phase or three-phase but simply a question of showing that any electric furnace produces the best metal. Mr. Loebell stated that suitable refractory non-conducting materials for the highest temperatures mentioned in Mr. Bartlett's paper had not yet been developed. Annealing offers a very desirable class of business because of its high load-factor. Mr. Dell Plain, referring to Mr. Snyder's paper, said that electric-furnace business promised great development, particularly for drop forgings, malleable castings and machine-tool parts of high quality. The business can be obtained even if it be found necessary to aid in promoting electric-furnace companies. Mr. Kearns stated that there is a field for electric-furnace business in almost every locality. The Detroit company is making a special effort to handle this business with single-phase current. It represents a good load under very favorable off-peak conditions. Mr. Snyder said that good steel can be made by several non-electrical processes. The talking point of the electrical furnace, emphasized only during the last two or three years, is that it produces good metal for the least money. He now has more than 500 inquiries from American steel people. Single-phase energy can do the work for one-half the cost of three-phase. The cheapest rate he knew to be given for electric-furnace supply is 5 mills per kw-hr. Another furnace pays 17 mills. In general the rate is about 10 mills. Furnaces running on single shift average from 45 to 50 per cent load-factor, and those nominally running for twenty-four hours have load-factors of 70 per cent. All furnaces operate on an off-peak basis, and the rates quoted are for high-tension supply. Mr. Dell Plain said that his company had just signed a contract for 800 kw for Snyder-type furnaces. The load will be taken at 11,000 volts from one-phase for twenty-two hours a day at 0.75 cent per kw-hr.

Report of Committee on Rate Research

Comparatively little work has been done during the year by the rate-research committee, of which Mr. R. S. Hale is chairman. There has been very little development that called for anything except possibly a restatement of fundamental principles and a reference to methods already developed and in use.

Six general principles have been followed. Net in-

come must be enough—not more than enough—to give a fair return and to attract capital freely. No rate should be below the expense involved solely by the addition of a customer or class, including a fair return on investment added or used exclusively for that customer or class. While customers whose circumstances are alike should pay the same rates, it is not necessary that customers whose circumstances are unlike in respect to the amount their class can afford to pay should be asked to pay the same percentage on the investment they use jointly, especially when they would not take the service if asked to pay such rates.

Increase in lamp efficiency has forced the possibility, which may become serious, that new lamps will take so few kilowatt-hours that central-station incomes will be affected seriously, but when this happens the expense for distribution systems, meters, etc., for house, store and other retail lighting will not be reduced correspondingly. In such a case the companies could not afford to make extensions or take new lighting customers unless rates were increased.

The committee's publication, *Rate Research*, has suffered somewhat from the general financial depression during the year. This loss has been made up partially, and the paper now has 423 paid subscriptions against 454 at the time of last year's report. One hundred additional subscriptions will put the publication in a strong position financially, and the Commercial Section has agreed to make the effort during the next six months to secure these names.

Discussion

The report was discussed by Messrs. J. E. Kearns, Schenectady; B. Hannon, Sacramento; J. Pearson, San Francisco; Henry W. Peck, Schenectady; George B. Johnson, Chicago; S. M. Kennedy, Los Angeles; E. W. Lloyd, Chicago; M. C. Osborn, Spokane; W. W. Freeman, Cincinnati; T. I. Jones, Brooklyn; Arthur Williams, New York; John F. Gilchrist, Chicago, and Harold Almert, Chicago. Mr. Kearns suggested that since the term kilowatt-hour is puzzling to the general public the use of household appliances might be promoted by a flat rate. Much of the overhead cost and annoyance to customers would be eliminated by having meters read quarterly instead of monthly. Mr. Hannon replied that his company had put in meters after experience with a flat rate had proved the difficulty of preventing customers from using energy for heaters when they are paying only for lighting. Mr. Pearson recounted a like flat-rate experience with electric-iron customers, who not only concealed their use but went so far as to warn neighbors when the inspector was coming. Mr. Peck said that he had found that the more household appliances a customer had the less likely was she to complain about monthly variation in the meter's reading which showed the combined energy consumption. Mr. Johnson stated that when the flat rate was used in Chicago customers allowed the lamps to remain in circuit unnecessarily.

Mr. Kennedy incited a discussion on whether a central station ought to sell energy at a price below its average station switchboard cost. Mr. Lloyd pointed out that a very low figure for ice plants had proved profitable in Chicago because these plants constitute a very desirable off-peak load. Mr. Osborn said that a customer buying energy at 8 mills with a 70 per cent load-factor is more desirable than one at 10 mills with a 35 per cent load-factor. Mr. Freeman, referring to Mr. Kennedy's remark, said that there are many instances where it is remunerative to take business below the average cost. However, each case must be considered by itself. Mr. Jones mentioned a case where a 5000-kw demand business during off-peak hours was secured by convincing the manufacturer to close an hour earlier each day instead of having a Saturday half holiday. The only investment required was for the extra coal. One should determine what extra charges a given kind of business involves before deciding upon the rates. Mr. Kennedy said that his experience had been like that of Mr. Freeman, namely, that there are cases where it pays to take business below the average cost. He remarked that the discussion was advantageous chiefly in view of the fact that regulating commissions do not understand always the reasons for variations in rates. Mr. Williams noted that if the community is to be served as a whole, it is necessary for the central station to serve the largest consumers as well as the smallest ones. In the long run the small consumer will be benefited by the fact that the large ones have been brought to the central station through attractive rates. In studying rates it is desirable to group users according to classes, such as railroads or large buildings, and determine the cost of supplying energy to each group. Ninety per cent of the overhead charges are due to the small consumer.

On motion, the report was adopted with the recommendation that the publication *Rate Research* be continued for at least another year.

Education of Salesmen

For the benefit of small companies, which are usually unable, for financial reasons, to conduct an organized educational department, the committee on education of salesmen, of which Mr. Fred R. Jenkins was chairman, has prepared a prospectus outlining a course of schooling for salesmen in central-station commercial departments. The committee has further taken upon itself the organization of educational departments in many of the company sections. Each subscriber to the course is to receive one lesson each month and will be expected to set aside enough time once each month to discuss thoroughly all questions pertaining to the lesson under the direction of the class leader and the head of the department in which he works. The committee has requested the co-operation of every company to insure the financial support necessary for properly conducting the work. The course includes instructions on selling, measuring energy and rates, illumination, and applications of motors. Under selling will be treated characteristics of a good salesman, essentials of selling campaigns, locating and following up prospective customers, advertising, merchandising, and relations with customers. Instructions regarding illumination deal with the characteristics of illuminants, maintenance and operating expenses, application of various units, lighting practice, display lighting and wiring. Under motor applications are discussed first cost, the characteristics and applications of motors, methods of proceeding to replace steam, gas and oil engines, the relative values of isolated-plant and central-station service, and the analysis of problems encountered in introducing central-station service.

Discussion

The report on the education of salesmen was discussed by Messrs. J. F. Gilchrist, Chicago; R. S. Orr, Pittsburgh; E. L. Callahan, Chicago; R. R. Young, Newark; S. M. Kennedy, Los Angeles; H. B. Pitts, San Francisco; P. A. Leach, Oakland; R. H. Ballard, Los Angeles, and R. L. Lloyd, Philadelphia.

Mr. Gilchrist said that manufacturers recognized the advantages of educating men for salesmanship long before the central stations did. The present move to standardize all courses for members and for students at low cost he thought to be a very desirable one. Textbooks made up directly from the latest practice are ab-

solutely necessary in a business which is advancing so rapidly, and he expressed his belief that the course deserves the heartiest support.

Mr. Orr said he was heartily in sympathy with the idea of having young men trained by those experienced in the field. Good motor-service salesmen are a necessity.

Mr. Callahan suggested that some might think that the courses are only for salesmen in large companies. This course is, on the contrary, intended for the smaller companies. The larger companies must, of necessity, have their own schools.

Mr. Young said that the Public Service Corporation of New Jersey has begun educational work in the gas field. A class leader is very desirable for the purpose of promoting interest. The meetings are held on the company's time. They are attended by many other employees besides salesmen, including bookkeepers, clerks, fitters and even firemen. In last year's course 65 per cent of the men received diplomas.

Mr. Kennedy agreed with Mr. Young that the course should appeal to all classes of employees, irrespective of the size of the company. His organization at Los Angeles holds meetings on company time every Monday morning. The younger and ambitious men realize that the commercial side of the business offers the greatest possibilities for advancement.

Mr. Pitts said his experience in San Francisco has been that with lectures only a lack of organization is manifest. There is no reason why the success of the correspondence schools could not be duplicated. Class organization with a class leader is possible, he thought, in even the smallest property.

Commercial Department Terminology

After study of the replies received in answer to its circular letter and report of March 5 suggesting titles for the departments and officials of central stations, the committee on commercial department terminology in its report declared its belief that the classification already submitted by it would receive favorable consideration from more companies than would any other classification presented up to this time. The designation "sales department" the committee declares to be the most appropriate name for the sales organization, the man in charge to bear the title of "sales manager." Out of sixteen letters sent to larger operating companies, eleven replies were received. Only two of the companies expressed themselves as willing to adopt in full the titles suggested by the committee. The position taken by different companies is shown by abstracts from their letters to the committee. The term "manager" has been proposed by the committee for the head of the department and the term "agent" for the heads of sub-departments or divisions usually found in large sales organizations.

Discussion

Mr. S. M. Kennedy, Los Angeles, said he thought the committee's suggestions were along the right lines. However, he declared that the use of the word "manager" in connection with sales would be misconstrued by the public as representing the sentiment of the company as a whole.

Mr. L. D. Gibbs, Boston, said he disliked the term "agent."

Report of Publications Committee

The report of the publications committee, of which Mr. E. A. Edkins was chairman, contained a comparison of the Commercial Section sales for three years, showing the growth of the committee's work and the recognition accorded it, a financial statement to February of this year, an outline of the committee's activities during the past year, and a list of booklets which the committee purposes issuing during the next few months, including a six-piece "store service" campaign. During the ten months from May 1, 1914, to March 1, 1915, the committee sold nearly 500,000 publications, a marked increase over the sales for the preceding two years of the committee's existence. The opinion was expressed that the next issue of the "Electrical Salesman's Handbook" should contain such material as is made available through the reports of the Commercial Section. It was also reported that the committee is preparing to launch a campaign to push the sale of Cushing's "Manual on Standard Wiring." The committee inquired why 82 per cent of the Class A members are not buying the Commercial Section publications.

Mr. C. J. Russell, Philadelphia, chairman of the subcommittee on the "Salesman's Handbook," in a letter stated that a third edition of the book would probably be necessary soon, with the illuminating section extensively revised because of the changing efficiencies of incandescent lamps.

Discussion

Among those who participated actively in the discussions were Messrs. T. I. Jones, Brooklyn, N. Y.; F. H. Gale, Schenectady, N. Y.; J. G. Learned, Chicago, Ill.; L. D. Gibbs, Boston, Mass.; M. C. Osborne, Spokane, Wash.; N. H. Boynton, Cleveland, Ohio, and F. D. Baker, San Francisco, Cal.

Mr. T. I. Jones explained that the residential-campaign publications need not be used as a whole but could readily be adapted for different situations.

Mr. F. H. Gale intimated that many members do not realize the tremendous value of the publications.

Mr. J. G. Learned said that seven years ago his company had begun with 6500 prospective customers. During the intervening years it has wired on an average from 1400 to 1500 houses a year. A large part of the company's success is attributable, he declared, to the Commercial Section publications.

Mr. L. D. Gibbs mentioned the splendid results obtained through the use of this literature in New England even by small companies. Literature, however, must not be expected to do all the work, but must be reinforced by personal effort.

Mr. M. C. Osborne asked Mr. Learned how he secured prospective customers and whether the wiring was done by sub-contractors. In Spokane, he said, more than 2000 house-wiring contracts have been secured by personal solicitation. These contracts were sublet to jobbers and wiremen on a payment basis of 25 per cent down and 25 per cent a month thereafter.

Mr. Learned said it is to be assumed that every central station has made a careful analysis of its own market. One reason why his company has more prospective customers than it had seven years ago is that the earlier surveys included only the more prosperous-looking houses. His company does wiring on the twenty-four-month payment plan. Contracts are sublet to contractors on a 10 per cent reduction basis.

Mr. Boynton thought that it would be far better to adopt the committee literature rather than to attempt to originate material.

Chairman Burnett described the practices of the Baltimore company. It is just as desirable, he maintained, to go after non-users in wired houses as to go after residents of houses not wired. Electric circuits are left ready for immediate use, and as the result many people who have moved into electrically wired houses have expressed their appreciation of the "live" wiring feature. At first the company left the service "alive" three months, then six, then nine, and finally has adopted the plan of leaving it so indefinitely.

In reply to a question by Mr. Baker, Mr. Burnett said that only 600 out of 40,000 customers in Baltimore are on the deposit plan.

Work of Society for Electrical Development

Mr. J. M. Wakeman, general manager of the Society for Electrical Development, Inc., outlined the work accomplished by the society during the last year. In his remarks he spoke of the work of Section No. 1, field co-operation under the direction of Mr. George B. Muldaur, and in connection therewith of the merchandising situation. Many contractor and dealer members have called upon the society to stop the sales of electrical devices direct to consumers by the central stations in their towns; and, on the other hand, several central stations have told the society that they do not join it because they will not allow anyone to dictate to them as to their policies of merchandising or any other policy. It seems that this phase of the situation needs clearing up.

Mr. Wakeman said that everybody is familiar with the man who takes any wiring job he can get, works hard, finds it hard sledding, tries to make a little on the material he uses in his work, and endeavors to eke out his livelihood by selling fans, irons and other household devices. He spends no money on a business-getting campaign, he does not advertise in the local newspapers, he sends out no printed matter, except perhaps a cheap handbill or mailing card setting forth his name and address, and a statement to the effect that he sells "everything electrical." He is one type of man who wants the society to fight his battles, wants the central station stopped in its efforts to sell appliances, etc.

The society has no means of stopping the sale of appliances by central stations, and in most cases it would be hindering, not helping, the development of the electrical industry if it attempted anything of the kind. In most cases central stations are the only force at work developing the local latent market; it is their business-getting department, their sales organization, their newspaper advertising, their display room, their persistent preaching of "Do it electrically," which creates the electrical business in their territory.

The society, Mr. Wakeman continued, does not make any pretense to control the merchandising situation, but it does try to show central stations generally that it is good business policy to obtain and retain the friendship and co-operation of the local dealers, contractors, etc., that it is better to have these men working with them than against them. Hitherto central stations have had to do practically all the local development work. All the education of the public has been done at their expense. Now the Society for Electrical Development is encouraging the local dealer and the contractor to do their share. These men, when members of the society, are contributing toward the expense of educating customers, as everything the society does is for the ultimate benefit of the central station.

"Electrical Prosperity Week"

Mr. Wakeman also discussed the plans for "Electrical Prosperity Week," from Nov. 29 to Dec. 4, 1915, which have been described fully in the ELECTRICAL WORLD.

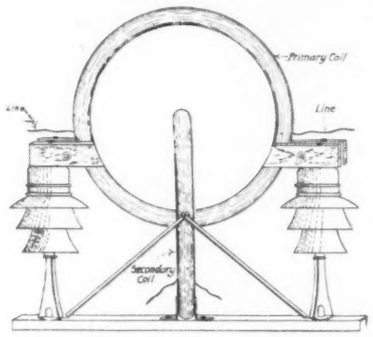
"We want you to become members of the Society for Electrical Development; get our assistance and give us yours," he said. "We can work together in this matter in such a manner that the business results to all concerned will more than repay us for the time, money and effort expended in this great movement. An organization is valued by the public as the men in the organization value each other and make the public realize it. That necessitates co-operation within the organization and with the public. That typifies the Society for Electrical Development."

METERS AND MEASUREMENTS

Report of Committee on Meters

The energies of the committee on meters, according to the report of Mr. C. G. Durfee, chairman, were devoted mainly to the revision of the "Electrical Meterman's Handbook," the revised edition having been printed for distribution at the convention. The recommendations of the committee with respect to the standardization of instrument and meter shunts are being followed in the manufacture of a large percentage of the shunts now on the market, according to the results of an investigation undertaken to obtain an expression of the feelings of the manufacturers on the subject.

The bulk of the 120-page report was, as usual, taken up with illustrated descriptions of new instruments, meters and accessories developed during the year.



OUTDOOR-TYPE INSTRUMENT TRANSFORMER

Among the demand meters was described a novel contact-making motor mechanism the speed of operation of which is independent of both the frequency and voltage of the circuit. A new development in metering practice is the inclosed mounting of a meter box with high-tension terminals for measuring high-voltage energy in outdoor substations. The equipment is available for pressures up to 22,000 volts. Another novelty shown was a high-voltage outdoor series transformer, the magnetic circuits of the series-primary and instrument-secondary coils being linked in air. The device was developed by the Niagara, Lockport & Ontario Power Company, which has had some of these series transformers in use on its lines. Descriptions of methods of testing instrument transformers and additional standardization data also appear in the report.

Discussion

The report of the committee on meters was discussed by Messrs. Otto A. Knopp, W. A. Hildebrand and S. J. Lisberger, Pacific Gas & Electric Company, San Francisco; F. G. Vaughan, General Electric Company, Schenectady, N. Y., and C. G. Durfee, Rochester (N. Y.) Railway & Light Company.

Mr. Knopp described several new types of meters developed in the Pacific Gas & Electric Company's laboratory. He recommended the use of cut diamond jewels in meters in order that the disadvantages of oiling jewel bearings might be eliminated.

Mr. Vaughan suggested that all central-station companies would do well to look upon the meter committee as a means of solving their problems. He suggested that they keep in close touch in order to assist in the formation of rules and to make effective use of the committee. A vote of thanks was extended to the meter committee.

ACCOUNTING METHODS

The report of the "Question Box" committee was not received, but Chairman Edwards stated that the committee has indexed topically all papers read before the association since 1907.

Uniform Systems of Accounts

In his report on a uniform system of accounts, Mr. J. L. Bailey, Baltimore, Md., chairman of the committee, said that objection has been raised during the last year to the committee's treatment of account No. 791, relating to sinking-fund accruals. He outlined a proposed new treatment. This is the only account changed in the classification as approved last year. Conferences have been held with a committee of the American Gas Institute with a view to harmonizing existing differences between the gas and electric classifications.

The apportionment of departmental overhead charges in combined gas and electric properties was discussed with relation to forms of organization and methods of allocation based on gross revenue, operating charges, etc., the conclusion being reached that such methods are unreliable and fallacious. The committee recommended that apportionment be left to individual judgment in each case and that the company's executives obtain a just distribution regardless of revenue or expense, and thus determine relatively true costs for just rates.

Discussion

Mr. Paul Jones suggested that if the mortgage has no specific provisions the sinking fund should be treated simply as a segregation of assets.

Chairman Edwards stated that the treatment of hydroelectric accounts has been based on Western practice.

Mr. F. J. Blanchard described his apportionment of overhead charges in recent commission cases.

Mr. W. J. Driscoll raised the question whether sinking-fund amounts would be available for dividends as bonds are retired.

In a letter Mr. W. E. Freeman suggested separation of the corporate surplus into appropriated and unappropriated surplus.

Chairman Edwards read an important letter from Mr. William J. Meyers, statistician of the Interstate Commerce Commission, making it clear that the New York and New Jersey treatment of sinking-fund accounts, for which Mr. Meyers was partly responsible through his connection with the New York rules, should be changed. The new rule recommended by the committee is in line with the present Interstate Commerce Commission practice. Mr. Edwards emphasized that a utility is entitled to the consideration of commissions so that if it liquidates securities from income it should be free to issue other securities for like amounts, provided it has the property to represent them.

Mr. R. H. Ballard said that the practice of retiring a certain number of bonds each year in a going public service corporation is old-fashioned. It is better to make, as does the Southern California Edison Company, a yearly investment in other property. It is impossible to do otherwise than to set up merely a temporary account for a sinking fund unless commissions will authorize rates allowing for both depreciation and sinking-fund requirements. A company must issue substitute securities for those retired from sinking funds. Recently the California Railroad Commission has authorized such issues. The committee's hydroelectric classification checks closely with that of the California Railroad Commission, but has the advantage that it is shorter. The segregation of accounts between districts or cities bothers large companies.

Chairman Edwards stated that the movement for a uniform system of accounts in all states is a big task and the greatest work before the committee.

Cost Accounting

The committee on cost accounting, of which Mr. J. H. Gulick was chairman, reported that it will study costs and methods of analyzing them.

Chairman Edwards mentioned that it may be necessary eventually to justify differential costs underlying differential rates.

Some Opportunities for Public Utility Accountants

Mr. L. R. Reynolds, auditor of the Railroad Commission of California, declared in his paper on public-utility accounting that he knew that he could speak for many of the state commissions in saying that they sincerely want a uniform system of accounts adopted in all states. Mr. Reynolds declared that this result can be consummated through the efforts of the Accounting Section.

Referring to the N. E. L. A. classification, the author declared that if there were an "unamortized premium on debt" there must also be at times an unamortized discount. The classification provides for a debt discount and expense and for its amortization, but uses the term "extinguishment." The classification also provides for a premium on capital stock. It is the experience of the author that fully as often there is a discount on stock and provision should be made for it. Under the classification, if it is found that after a physical examination the book value of a property does not equal the physical or inventory value, no alternative is provided but to charge the difference to profit and loss, although the history of the corporation may show clearly that the par value of the stock as carried in the liabilities is not represented by an equal value in the plant accounts.

The interpretation of the depreciation account is exceedingly difficult and one fraught with danger. Mr. Reynolds said that many times he would like to see it eliminated altogether. But if it is eliminated, by what means, he asked, can the cost of maintenance be equalized through the years? If all possible available funds are required for new extensions in a year when interest rates are very high and conditions are such that the company does not wish to borrow outside capital, it is perfectly legitimate to postpone maintenance that can be dispensed with until the ensuing year when funds may be obtained at a lower rate.

Where immediate service extensions must be made it is necessary to appropriate blanket sums of money to be expended with the approval of officials. It is found, however, that an immense number of utilities make multitudinous small charges to capital without order or system. This evil results generally in the understatement of expenses and overcapitalization. All so-called overhead charges to construction should be accompanied by a very full explanation covering both the philosophy of the charge and authority therefor.

Analytical Accounting for Central-Station Companies

In his paper Mr. O. B. Coldwell said that while present classifications of accounts are unquestionably of great value, it would seem that they do not provide adequately the information needed for complete analysis of the business. Regulation has brought about a condition where knowledge of cost of rendering classes of service is necessary as one of the elements entering into the justification of rates. Analytical accounting, applied in some such manner as was outlined, will be the solution. Analyses of

individual cases must result necessarily in the use of different bases for the distribution of costs, but the underlying principle of analysis will be uniform.

Mr. Coldwell's paper was discussed by Messrs. J. L. Bailey, Baltimore; Paul R. Jones, of the Doherty companies, and W. A. Hillebrand, San Francisco. Mr. Hillebrand mentioned difficulties in the way of reliable cost accounting and the influence of fluctuating seasonal demands on costs. He believed that the only purpose which an analytical distribution of costs serves is to determine whether there is undue discrimination as between classes of consumers.

Statistical Machines

A paper on statistical machines by Mr. W. E. Freeman, New York, summarized the information on this subject which has been presented at previous meetings of the Accounting Section and described a new machine combining the Hollerith tabulating device with a recording and totaling device, providing a printing machine which was not available previously. Illustrations showing the classes of work done by the New York Edison Company with various machines, and statements of the advantages gained by the use of each were presented.

Electric-Vehicle Cost Accounting

Mr. W. P. Kennedy pointed out in his paper the desirability of reducing statements of the cost of automobile equipment service to some definite and generally accepted form which will show the investment involved, the annual expense of the entire equipment, and the daily charges against the units of the vehicle fleet in question. Such a common basis of accounting would greatly facilitate the comparison of operating costs of companies using vehicles under different conditions. Mr. Kennedy proposed for general adoption the use of two schedules, A and B, of the form employed by him in his recent elaborate study of electric-truck operating costs made for the ELECTRICAL WORLD, the results of which were published at length in our issue of May 22, 1915.

Discussion

The paper on "Electric Vehicle Cost Accounting" was discussed by Messrs. Day Baker, Boston; Welles E. Holmes, Cambridge, Mass.; W. J. Driscoll, general auditor, and J. D. Butler, San Francisco district auditor, Pacific Gas & Electric Company; Paul Jones, New York; Goerge R. Murphy, San Francisco; Harry W. Harrison, Los Angeles, and Chairman Edwards.

Mr. Day Baker stated that the Anheuser-Busch company and other corporations had checked Mr. Kennedy's estimates with their costs and found them practically correct. Experience is proving that electricity as a prime mover of merchandise is cheaper than horses or gasoline. He stated also that 4 cents per kw-hr. was selected for the report as the average price over the United States. Mr. Marshall reported that companies find that if they charge themselves 4 cents per kw-hr. they can operate electric cars cheaper than gasoline cars. Mr. Driscoll stated that his company estimates 7 per cent interest on the investment and four years for the life of a machine. Mr. Butler of the same company, who is closely in touch with the San Francisco automobile service, said that formerly electric cars were inadequate, but that now they are built good enough to run at least ten years even in hilly San Francisco.

Mr. Harrison, who is the proprietor of the largest electric garage west of Chicago, further testified to the long life and low repair cost of electric cars. He uses more than 30,000 kw-hr. per month and gets a rate, including the off-peak discount, running as low as 1.3 cents.

Mr. Marshall said that there had been too much of a tendency for electric-vehicle men to put stress on cheap rates for energy and central-station men on cheap vehicles. Central-station executives now agree on the policy of using electric cars unless it is conclusively demonstrated in a particular case that a gas car is so much better that an electric vehicle cannot be considered. The ELECTRICAL WORLD cost tabulations have been based on exceedingly valuable returns from several hundred installations. Mr. Day Baker explained that 3 per cent interest on the total investment allowed in Mr. Kennedy's tables is an average that takes account of the annual diminution in value due to the depreciation. Chairman Edwards said that the New York Edison Company has only two gas cars out of 100 vehicles.

Record of Property or Construction Expenditures

In his paper on records of property or construction expenditures Mr. T. R. Ferguson emphasized the necessity of careful and comprehensive records of all property acquired or constructed. Such records, he declared, will reduce the labor required on inventories made up for governing and regulating bodies, and even perhaps decrease the demand for such reports. A system of record keeping including twelve typical record forms was given. When work is undertaken, daily time cards, requisitions for materials, estimates of probable monthly expenditures, and preliminary and final completion reports, together with appropriate labor and property bookkeeping ledgers, are desirable.

Discussion

The paper on records of property expenditures was discussed by Messrs. C. E. Calder, Dallas; D. M. Speed, Fresno; J. L. Bailey, Baltimore; Paul Jones, New York; R. C. Bulger, Visalia; F. J. Blanchard, San Francisco; C. O. Kennedy, Massillon, Ohio, and Harold Goodwin, Jr., Philadelphia.

Mr. Calder's company, the Wichita Falls Electric Company, has information in its construction ledger classified by requisition numbers. From one ledger it can prepare at any time information by districts or classes. Mr. D. M. Speed, auditor of the San Joaquin Light & Power Corporation, Fresno, said that his company has all costs analyzed by an engineer before they are entered on the books.

Mr. Paul Jones told of the Doherty company's system, by means of which a work order is made out for every job and the gang takes out on the wagon as much material as the foreman wants. Mr. Bulger uses a merchandise expense account covered by the commission classification. Mr. Kennedy salvages everything not used when a job is finished, credits the salvage to the job, and charges it with the loss. Mr. Blanchard said that the bookkeeping should be flexible enough to permit the entry of items long after a job has been closed, as in the case of the settlement of an injury damage case.

Mr. Goodwin, speaking as an engineer, mentioned the difficulties arising from foremen writing up work reports at night. The company has tried putting miscellaneous material for each job in a separate basket.

Chairman Edwards said that it is largely up to the engineers to work out a system so the man on the job can let the accounting department know what he did, where he did it, and how much time was consumed.

Almost 8000 Data Forms on File

Two sets of 7740 data forms have been received from 126 different companies and are now filed for the use of N. E. L. A. members, according to the report of the library committee, of which Mr. E. J. Allegaert was chairman.

MISCELLANEOUS SUBJECTS

Mr. Lüpke on "Revivals"

In another of his kindly and philosophic preachments, which have been bright features of N. E. L. A. conventions for many years, Mr. Paul Lüpke discussed the desirability of periodic "revivals" to keep organizations and operating staffs from "getting into a rut." "The most carefully worked-out efficiency plans have a creeping tendency to grow a crust of superficiality that has to be ground off now and then," declared Mr. Lüpke.

"The narrowing margin of possible increase in efficiency compels the installation from day to day of more intricate apparatus and the application of higher scientific methods in properly caring for it. It is a comparatively easy matter to obtain men qualified for the construction work because this work offers a stimulating variety; but to retain able and thoroughly conscientious men in the operating field, with its grueling monotony of daily recurring routine, is a serious problem. If you allow the refinement of your appliances and the precision of your instruments to outrun the skill of the operator in handling the former, as well as his ability to interpret the latter, all your effort is in vain and your outlay is wasted.

"A word of warning concerning the revivals you administer to the operating men is, therefore, in order. Let them be earnest, let them be full of stern common sense; shun the irritating, nagging hysterics that only phlegmatic, fat men can survive."

Turning to the subject of relations with the public, Mr. Lüpke urged that the community be made to appreciate that the benefits the stockholders derive from a wide-awake utility company are small indeed in comparison with those self-evident indirect advantages in which the whole community shares.

Workmen's Compensation Insurance

Mr. Walter G. Cowles, vice-president of the Travelers' Insurance Company, discussed the advantages of stock-company insurance from the financial point of view. It is a particular province of stock insurance to reduce the uncertainties of future losses to a present fixed and known value. In business the probability of unknown losses is faced constantly. One important means for effective distribution of losses at a fixed cost to policy holders is the wide distribution of risks. Under the mutual insurance plan the payment of a premium does not discharge the obligation. On the contrary, it binds a company to new and perhaps vastly increased obligations. Mutual insurance is fundamentally unfitted to the compensation obligation. The lines where mutual insurance has demonstrated its usefulness are those lines where liquidation follows loss immediately. With compensation insurance losses are incurred during the policy term, but liquidation is postponed by law. Mutual companies without agencies do business in a very limited territory. They fail in distribution and volume and therefore their mathematics are much more uncertain than those of stock companies with agencies, because they cannot rely safely upon the law of averages.

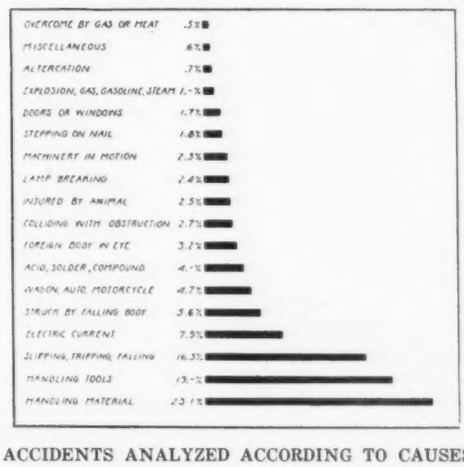
In compensation practice the element of unfair claim-making is troublesome. The large compensation insurance companies have had much experience and have an organization which enables them to keep in touch with men wherever they go. The basis for compensation for injuries has been changed materially under the new laws, but accident frequency has not been changed. Rapidly increasing efficiency in electrical enterprise, a high respect for a dangerous product and marked improvement in appliances and safety conditions contribute largely to the result found in Europe, that insurance cost in the electrical industry has not increased although it has done so in nearly all other industries to an amazing extent. The rates which stock insurance companies charge are much less experimental than the legal obligations against which they are devised as a protection.

Discussion

A written communication in discussion of the paper on "Workman's Compensation Insurance" was received from Mr. Albert W. Whitney, of the Workman's Compensation Service Bureau, New York, who outlined the indirect sociological effects of workman's compensation insurance provided for by laws in thirty-one states during the past five years. Mr. Henry W. Peck, of the Schenectady Illuminating Company, reviewed the practice under the New York law and the advantages of mutual organization, including the ability to engage direct interest of members and services of inspectors technically skilled in this particular industry.

Accident Prevention

Owing to the publicity which has been given to results obtained in large industries by organized accident prevention, general interest has been stimulated in decreasing hazards. To decrease still further avoidable accidents the committee on accident prevention, of which Mr. Martin J. Insull was chairman, recommended that organization plans be published which will meet the requirements of both large and small operators. Many companies have reported that preventable accidents to their employees have been decreased by 30 or 40 per cent, and even as much as 60 per cent, but there will always be a certain number of accidents from causes that are unavoidable. For first-aid treatment the committee recommended the use of the National Affiliated Safety Organizations' standard first-aid jars and a complete set of "Instructions to Laymen for First-Aid Treatment of Common Injuries and Disorders." The committee recommended that a permanent exhibit of unpatented safety devices used by member companies be maintained. It was also suggested that arrangements be made so that companies can obtain advice regarding industrial safety and sanitation.



ACCIDENTS ANALYZED ACCORDING TO CAUSES

The accident prevention committee presented for approval a re-draft of the "Safety Rules to Be Observed in the Operation of Electrical Equipment and Lines," drawn up by the committee in conference with the United States Bureau of Standards. The rules presented were those given in the second edition of Circular No. 49 of the Bureau of Standards, an abstract of which was published in the ELECTRICAL WORLD of May 1.

Nine charts were presented showing the causes and

effects of accidents in the electrical industry. It is interesting to note that 43 per cent of the accidents occurred in or about the company's premises, while the remaining 57 per cent occurred outside. Of the total, 23.1 per cent were caused by handling material, 24.5 per cent by falls and falling bodies, and 33.4 per cent by laceration.

Public-Service Companies and Accident Prevention

The prosperity and welfare of the people and that of the public-service companies go hand in hand, and whatever benefits one will benefit the other, declared Mr. Charles B. Scott in his paper entitled "The Opportunities of the Public-Service Companies in General Accident Prevention." Accident prevention is not simply an industrial problem but also a social problem in which every citizen should be interested and share a responsibility. The successful manager of a public-service company is not one who directs all his efforts to increasing revenues and dividends, but one who takes a broader view and realizes that a cordial relation with the public is his company's chief asset. Results cannot be obtained in the safety movement until every person exposed to danger is made to appreciate his personal responsibility in accident prevention. Public-service companies, because of their intimate relation with the public, have an excellent opportunity for educating the people. The employees can, by timely suggestions, impress upon consumers the need of caution and the desire for greater safety. As newspapers reach a large number of people, they can be employed with beneficial results in creating general interest in accident prevention and personal caution. "Inserts" and stickers presenting practical, common-sense safety suggestions can be sent out with literature and monthly bills. The foregoing methods may be slow in bringing results, but the effect is cumulative and will eventually produce the desired action.

Discussion

The reports above abstracted, relating to accident-prevention topics, were discussed together, the discussion being entered into by Messrs. M. C. Turpin, Westinghouse Electric & Manufacturing Company, Pittsburgh; J. A. Lighthipe, Southern California Edison Company, Los Angeles; C. A. Gilkerson, Public Service Company of Northern Illinois, Chicago; E. R. Northmore, Los Angeles Gas & Electric Corporation; B. L. Crawford, Hubbard & Company, Pittsburgh, and C. D. Scott, Middle West Utilities Company, Chicago. Mr. Turpin stated that the Pittsburgh manufacturers had formed a safety council which has proved effective in preventing the duplication of effort in safety work by circulating among all plants the safety devices developed at each plant. Mr. Gilkerson stated that after a year of organized effort in studying accident prevention 1000 suggestions for means of preventing accidents were made, of which 96 per cent were adopted. He reported good results from occasionally chartering a theater in which to illustrate accident-prevention and safety work for the benefit of grammar and high-school students.

Relations with Educational Institutions

The committee on relations with educational institutions, of which Mr. John F. Gilchrist, Chicago, is chairman, consists of members of the faculties of engineering schools and members of the N. E. L. A. The work of the committee has been apportioned among four subcommittees—a committee on interchange of lectures to be delivered by electric-lighting officials before educational institutions and by members of college faculties before utility companies; a committee on curricula to draw up courses for specific training of men in the lighting business; a committee to deal with arrangements for employment of undergraduates and professors by utilities during vacation periods and after graduation, and a committee to distribute publications and literature of the industry among colleges. The initial report of these sub-committees, which have been at work during the year, forms a substantial part of the report of the main committee.

The sub-committee on the employment of graduates and undergraduates reported it had undertaken to place about 250 college students with various companies, and that forty of the leading utilities of the country have already signified their intention of employing students during the vacation period. It is expected that most of these will be employed in the new-business departments. There was no discussion on this report.

Report of Committee on Terminology

The report of the committee on terminology, Dr. A. S. McAllister chairman, presented for official confirmation by the N. E. L. A. a number of terms and definitions selected from reports of committees of other organizations in which the N. E. L. A. was represented, either officially or unofficially. This material was arranged in logical order and edited to avoid all appearance of conflict. Particular attention was called in the report to the present committee's definition of diversity factor, which is defined as "the ratio of the sum of the maximum power demands of the subdivisions of any system or parts of a system to the maximum demand of the whole system or of the part of the system under consideration, measured at the point of supply." It will be noted that the diversity factor as here defined must always be equal to, or greater than, unity. In the report of the committee on terminology in 1912 the diversity factor was so defined as to always be less than unity.

Report of Committee on Company Sections

The committee, of which Mr. F. J. Arnold was chairman, expressed itself as assured that the company-section idea is successful and that the results which have been obtained have thoroughly warranted the efforts made. Although the general Class B membership has heretofore shown a marked annual increase, there should be no discouragement at the slight reduction this year as this is explained by business conditions.

Some local organizations have developed very effective educational programs which include not only the convention proceedings, the question box and the various publications of the association but also other valuable literature. Reports indicate that the smaller sections have realized exceptionally beneficial results from association literature.

Company-Section Work

Each section of the association, said Mr. D. C. Bruce in his paper, has been operated according to its own local plans, a procedure which has meant duplication of much time and effort. Some sections have had very interesting and instructive programs, while others have failed to accomplish the desired results, owing principally to the lack of experience and of a definite source from which to obtain assistance and advice. To take an interest in any study aside from his regular occupation the employee must feel that he is getting a return on the time and energy expended in company-section work; but connection with such a movement must also be at some cost to him. It is the hope that before long the section will be able to broaden out its educational work through the use of the Commercial Section plan for correspondence courses.

The System of the Montana Power Company

Operating Methods and Features of Hydroelectric Plants Serving Important Mining, Irrigation and Electrified-Railroad Loads

BY MAX HEBGEN*

EXTENSIVE indeed has been the development and utilization of hydroelectric energy in western Montana, where the transmission lines of the Montana Power Company and associated systems link together some eighteen water-power and steam plants, distributing their output to forty or more towns and cities besides supplying very large amounts of power for the important irrigation, mining and railroad-electrification loads in the district covered by the high-tension distribution network.

The loads in the mining and smelting districts are of relatively high load-factor, the largest demand of this kind being at Butte, served by 35,000 kw of substation rating, at Anaconda with 20,000 kw of total rating, and at Great Falls where the Boston & Montana smelter of the Anaconda Copper Mining Company consumes 8000 hp, partly hydraulic and partly transmitted electric power. There are also many smaller substations supplying power to other mining districts, as well as 2600 kw of substations serving contractors on the Sun River Project of the United States Reclamation Service. About 3600 kw in substations is required to supply the coal-mining load. The irrigation pumping loads aggregate 4000 hp in motors.

The Butte, Anaconda & Pacific Railway's 90 miles of 2400-volt electrified main-line track are operated from the Montana Power Company's system. The first section of the 452 miles of the Chicago, Milwaukee & Puget Sound Railroad's mountain division, all of which is to be electrified, will be ready for electric operation this fall, using energy from the new Great Falls and Thompson Falls plants of the power company.

*General manager Montana Power Company.

Extent and Growth of the System

The chief sources of hydroelectric power in Montana are in the headwaters of the Missouri River from their sources in the southwestern part of the State and in Yellowstone Park, at an elevation of about 8000 ft. above sea level, down to the relatively flat country in central Montana, at about 3000 ft. elevation. Clark's Fork of the Columbia River, in the northwestern portion of the State, also affords valuable water-power sites. Precipitation in Montana varies from about 30 in. per year in the mountains to about 14 in. per year at the lower elevations.

The present system of the Montana Power Company and of the Great Falls Power Company operating in physical connection with the Montana Power Company's lines furnishes nearly all electrical service in the western part of the State. The territory thus supplied extends 250 miles in a north and south direction and 225 miles in an east and west direction, although these dimensions will be increased respectively to 250 miles

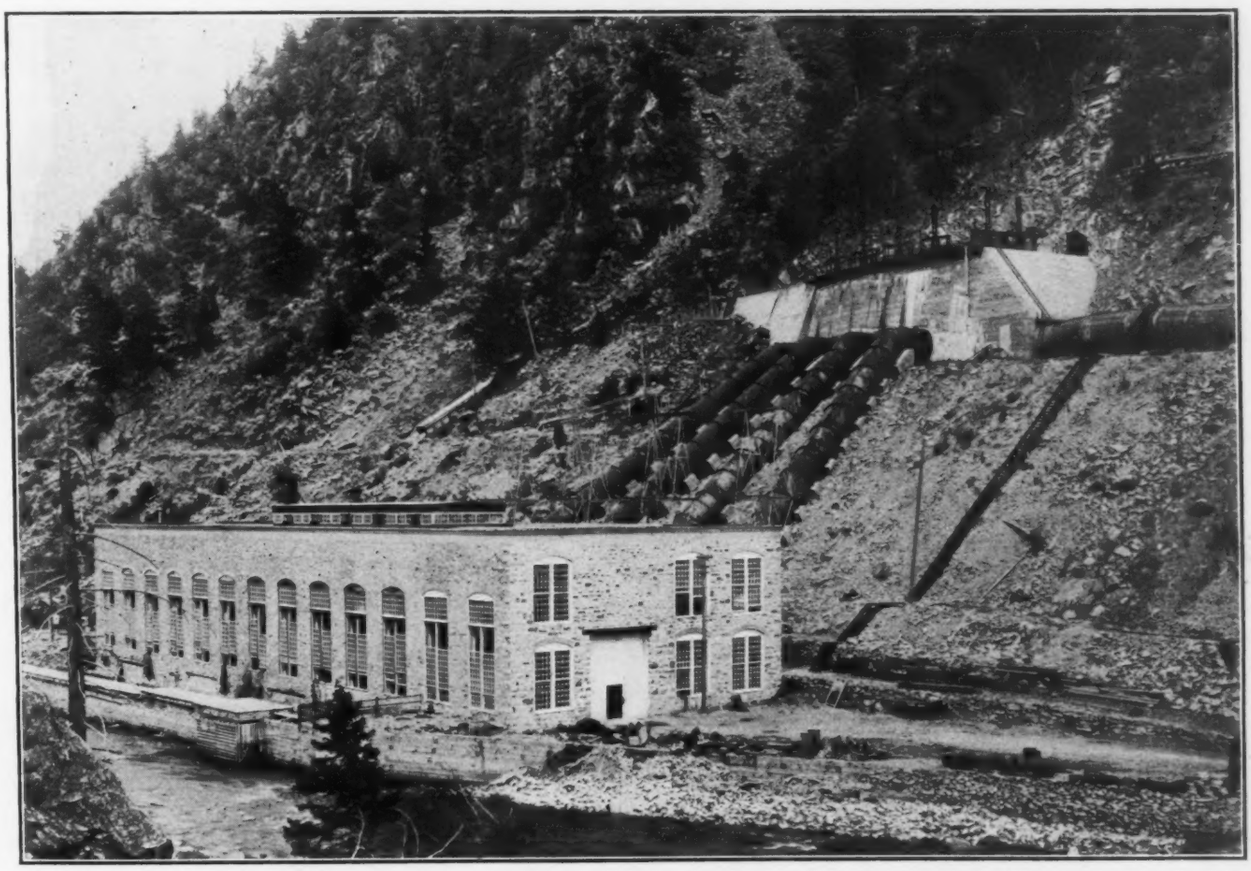


FIG. 1—MADISON PLANT OF THE MONTANA POWER COMPANY—EQUIPMENT, FOUR 3700-HP HORIZONTAL TURBINES

and 400 miles upon the completion of the Thompson Falls plant now being built on the Clark's Fork River at Thompson Falls.

All the plants of the company, with the exception of the Thompson Falls station, are on the Missouri River or its tributaries, and taken as a group they afford interesting illustrations of the rapid growth of hydro-electric transmission and of the advance in apparatus and methods.

The Big Hole plant transmitted 22 miles at 15,000 volts in 1897. The Madison plant adopted 46,200 volts in 1906, the Canyon Ferry plant 50,000 volts in 1902 and 70,000 volts in 1905. The present standard of 102,000 volts was adopted for the Rainbow plant, transmitting 130 miles to Butte and 23 miles further to Anaconda, in 1910. The same voltage will be employed for the Great Falls development and the Thompson Falls development, and for the trunk line feeding electric power to the 452 miles of the Chicago, Milwaukee & St. Paul Railway, both being electrified. Growth of the load on the system is graphically shown by the curve reproduced in Fig. 8, which indicates that the total rating of the plants now being built will be entirely absorbed about the year 1918.

The aggregate ratings of the company's generating stations and substations are 75,580 kw and 99,543 kw respectively, while the maximum load during the year 1914 was 61,000 kw. During the same period 402,663,369 kw-hr. of energy was generated and 365,145,736 kw-hr. was delivered to consumers. About 3.5 per cent of the energy delivered was used by the residence consumers, who number 20,653, while the majority of the energy, 96.5 per cent, was utilized by 996 industrial concerns. The annual load-factor was 75 per cent and the mean monthly load-factor was 80 per cent. The loss in the transmission system amounted to about 10 per cent of the energy delivered.

Transmission Lines

The transmission lines have a total length of 1465 miles, made up of 342 miles of steel-tower line, 523 miles of suspension-insulator-type pole line, and 600 miles of pin-type pole line. Suspension insulators are now used for all pressures above 45,000 volts.

There are now under construction, in addition to the feeder lines being built by the Milwaukee railway, 320 miles of two-pole, 102,000-volt, bridge-type lines, using 440-ft. standard spans, and 20 miles of suspension-type pole line, using 350-ft. spans.

The minimum size of wire used on lines up to 88,000 volts is a strand of three No. 8 copper wires. For 102,000 volts the minimum size is No. 0 seven-strand conductor. In special cases where the required mechanical strength and diameter necessary to prevent corona loss is considerably greater than the economical size of copper wire for the expected load, stranded steel wire of suitable size has been employed.

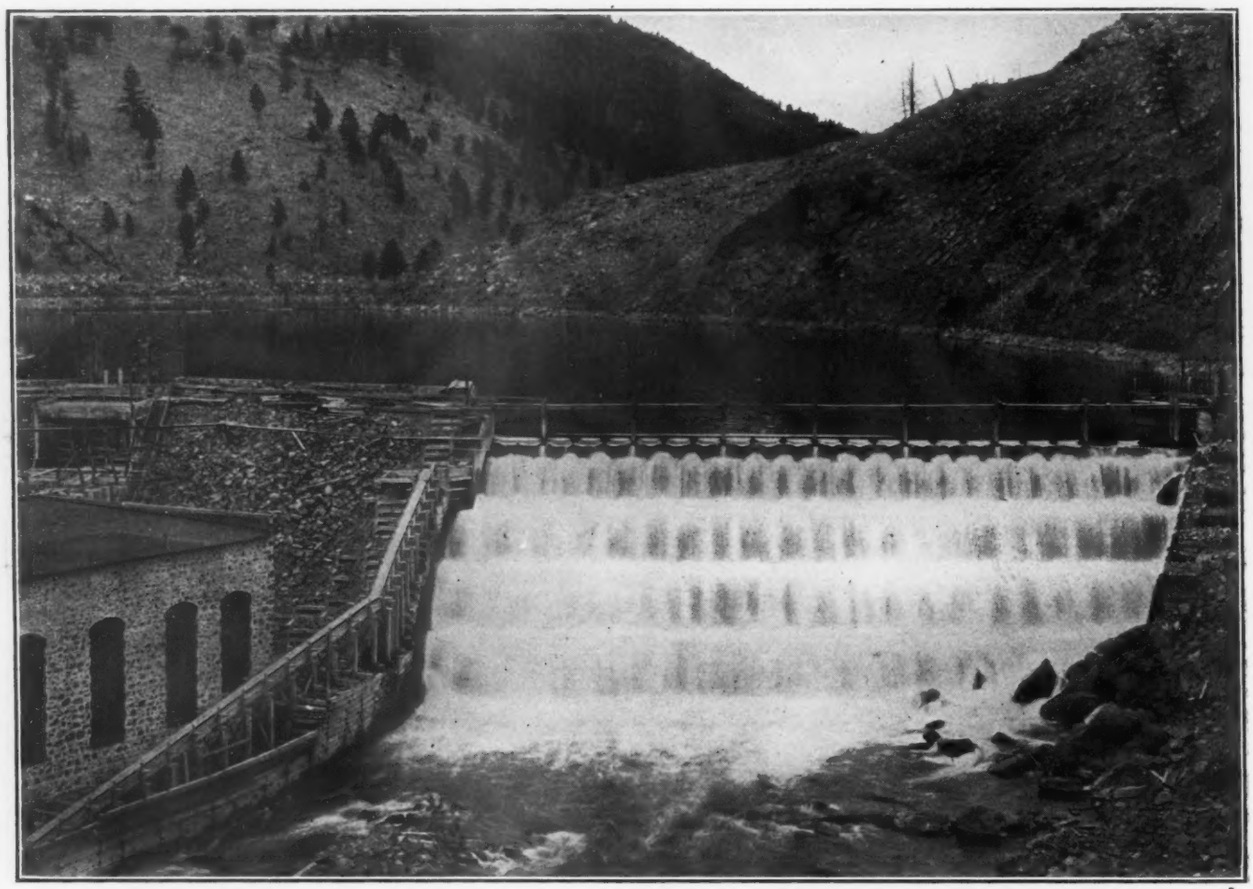


FIG. 2—BIG HOLE DAM OF THE MONTANA POWER COMPANY—3000 KW DEVELOPED AT THIS PLANT UNDER 60-FT. HEAD

Conserving Use of Water

An interesting feature of the system is the fact that by the physical combination of the various plants operating on the same river and using the same water in series there results an opportunity to use stored water successively through each of the plants and by proper load dispatching to prevent waste which would be inevitable if the plants were separately operated.

A special record is kept to show not only the actual daily water flow at each plant, but also the acre-feet of water in or out of storage each day and the natural flow of the river which might be expected if no storage ca-

pacity were available. There is a time lag of about six days between the Hebgen Reservoir and the Great Falls plants, but fortunately the intermediate plants have ample storage to supply sudden demands or to hold water not immediately needed, so that economical use of the water is not seriously interfered with by this time lag.

The Big Hole and Madison River Plants

At the Big Hole plant is a rock-filled timber-crib dam, developing 65 ft. head. Short steel penstocks conduct the water to four Leffel turbines, each driving a 750-kw generator. The original turbine runners are still in service after seventeen years' use, and show only slight wear. These old-type generators are of such rugged construction and of such high reactance that it is common practice to throw them directly onto the line and to allow them to pull into step, which they readily do without any signs of distress.

The 15,000-volt, 22-mile transmission line to Butte was built with unusually heavy cedar poles, with tops ranging from 9 in. to 11 in. and in some cases even 12 in. in diameter. Double-barbed ground wires were installed and the line has been singularly free from interruptions, either from lightning or from breaking of the barbed wire.

Following preliminary construction developing a 25-ft. head by a low dam, the present Madison River plant was constructed in 1905 and 1906. A 40-ft. rock-and-concrete-filled timber-crib dam near the head of the Madison Canyon impounds a reservoir of 2020 acres area. Two conduits, one 12 ft. and the other 10 ft. in diameter, extend 7415 ft., discharging into a balancing reservoir, from which steel pressure pipes supply the water to four 3700-hp double horizontal Leffel turbines.

The original 46,200-volt transmission lines to Butte were two in number, using No. 1 stranded aluminum wire on Provo glass insulators, which were mounted on 21-in. locust pins. These lines have shown no unusual operating features, except that in recent years cases have developed where the wearing of the wire at the insulator, apparently due to constant swinging in the wind, has weakened the wire to the breaking point.

In 1908 in order to carry increased load these lines were paralleled by a steel-tower line of No. 0 stranded copper on suspension insulators. Owing to delay in the delivery of sufficient insulators it was decided to use units of two General Electric disk insulators reinforced by a 3-in. by 3-in. by 20-in. treated wooden stick inserted in series. This scheme has proved eminently successful in practice, and this 61-mile line has been entirely free from insulator trouble. The treated wood sticks show only a very slight surface weathering.

The Canyon Ferry Plant

The Canyon Ferry dam is of the rock-filled, timber-crib type. The equipment comprises ten 1000-hp double horizontal turbines, each connected to a 750-kw, 550-volt generator. The 550-volt switchboard is equipped with air-break circuit-breakers and triplicate busbars to which connection is made by knife switches. While, of course, this type of board is long out of fashion, it has proved through many years of service to be absolutely reliable, simple in operation, and entirely unacquainted with the term "physical depreciation" and "maintenance cost."

Transmission from this plant is, over four circuits of No. 4 solid copper, 17 miles to Helena and vicinity at 12,000 volts, and, over two No. 0 stranded copper lines operating at 70,000 volts, 65 miles to Butte and to intermediate points. The 12,000-volt pole lines, built in 1898, were equipped with two-part 4½-in. glazed porcelain insulators on 9-in. wooden pins. The lapse of time has shown a gradually growing tendency of these old insulators to leak through the porcelain and to digest and in some cases burn the pin tops. The 70,000-volt lines, built in 1902, are somewhat noteworthy in that they are insulated with 9-in. glass insulators on 18-in. treated wooden pins, the pins being protected by glass sleeves. These pins have shown no tendency toward digesting or burning, and recent tests show that such a treated pin is still capable of standing a test potential of 75,000 volts to 100,000 volts from end to end. The pins were treated in paraffine at about 220 deg. Fahr. under 15 in. of vacuum, followed by the application of pressure as the paraffine was allowed to cool off.

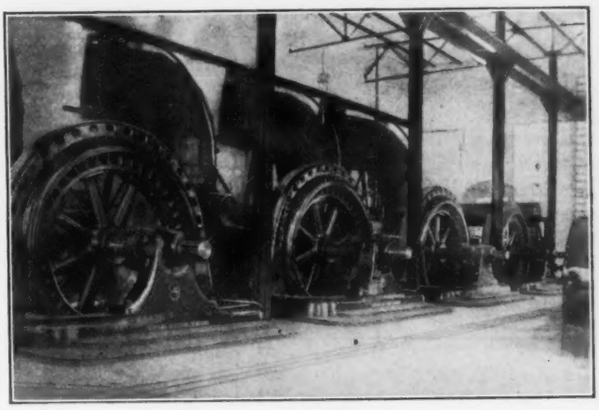


FIG. 3—INTERIOR OF BIG HOLE PLANT, CONTAINING FOUR 750-KW TURBINE UNITS

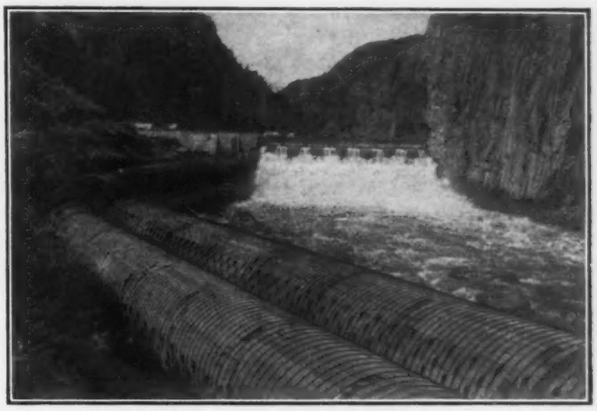


FIG. 4—MADISON DAM AND PIPE LINES—PIPES 10 FT. AND 12 FT. IN DIAMETER

The station has always been operated without automatic circuit-breakers with the exception of automatic breakers on the low-tension side of the 12,000-volt feeders to the Helena district.

The dam was recently examined, when fourteen years old, and all interior timbers were found to be practically as sound as the day the dam was built. This is probably due, in part at least, to the 10 ft. of flashboards which are maintained at all times except during flood. These boards ordinarily leak just about enough water to keep the timbers thoroughly saturated.

A novel method is used to prevent ice pressure from affecting the dam and flashboard system. When cold weather is expected a galvanized-iron wire is strung on floats just upstream from the crest of the dam. The wire is heated by electric current sufficient to maintain an open strip of water. About 5 kw is the maximum requirement for a wire 500 ft. long.

The back-water pond is about 6 miles long by 1½

FIG. 5—INTERIOR OF MADISON PLANT, SHOWING HORIZONTAL TURBINES—OPERATING HEAD 110 FT.

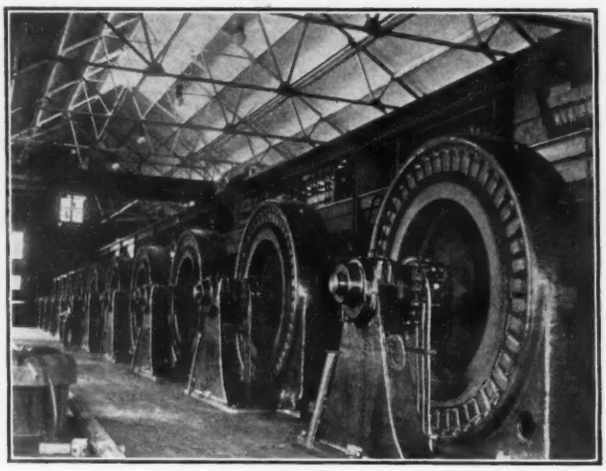


FIG. 7—THE TEN 750-KW UNITS IN THE CANYON FERRY PLANT

miles wide, a size which effectually prevents trouble from frazil or flood ice and provides a very useful storage of water.

The Hauser Lake Development

The Hauser Lake dam is a solid concrete gravity-type structure, 130 ft. high from bed rock to the top of the bridge. The normal head is 65 ft. The dam is situated 18 miles below the Canyon Ferry dam, and forms a pond reaching up the Missouri River to the toe of the Canyon Ferry dam, with a branch into the valley of Prickly Pear Creek, reaching to within 8 miles of the city of Helena. Like practically all of the hydraulic plants of the company's systems, the dam is provided with removable flashboards, which in this case are designed to maintain the water 14 ft. above the crest of the spillway. From the short forebay canal similar to that at Canyon Ferry, the water is led to six pairs of horizontal turbines, each pair developing 4000 hp and driving a 2800-kw generator. The low-tension buses are in duplicate, while the high-tension side of the transformers is connected through selector knife switches to a ring bus system, which is also sectionalized by knife switches and to which the two transmission lines are connected through time-limit automatic oil circuit-breakers.

The creation of the Hebgen Reservoir on the headwaters of the Missouri River so increased the minimum flow of the river that a sixth 3750-kw generating unit has been added to the Hauser Lake equipment. Since no provision had been made in the original design for this sixth turbine set, it was necessary, in order to install the headgates, to buttress the canal wall so as to support a special cofferdam inside the canal. This cof-

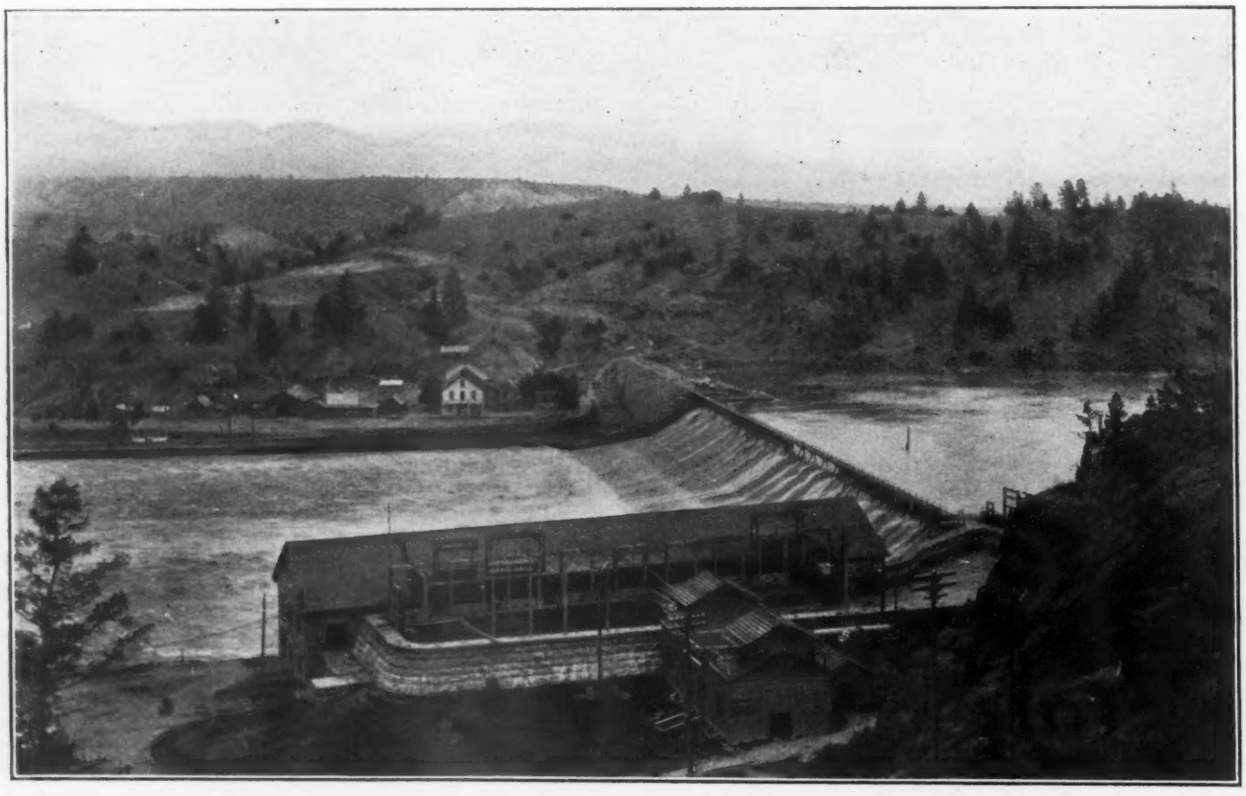


FIG. 6—CANYON FERRY PLANT OF THE MONTANA POWER COMPANY, RATED AT 7500 KW

ferdam sustains at the bottom a head of 35 ft. To make tight the seal joint between the cofferdam and the canal wall, several thicknesses of very heavy canvas were nailed along the seal edges to make a semi-circular pocket. After the cofferdam had been sunk into place this pocket was grouted full under pressure. The result was an absolutely tight joint except in one place where there was not sufficient looseness in the canvas to fill

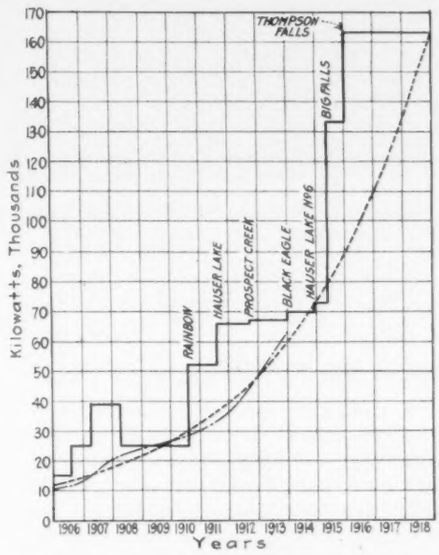


FIG. 8—SYSTEM RATINGS AND MAXIMUM LOADS FOR THE YEARS 1906-1915

the joint, which then required extra calking on the outside.

At this plant no tendency towards ice thrust has ever been observed; doubtless because of the depth of the lake, which, being covered with ice and snow, accumulates heat in the lower stratum of the water. This stratum becomes mixed with the colder water as it approaches the dam and so keeps the surface adjacent to the dam and intake almost entirely free from ice.

Black Eagle Station

Situated just below the city of Great Falls on the Missouri River is the Black Eagle dam, built on the crest of Black Eagle Falls in 1890 for the double purpose of furnishing hydraulic power to the Boston & Montana smelter at Great Falls and operating the city lighting plant on the opposite side of the river. With the natural head of the falls the dam develops a head of 43 ft. About 8000 hp is used in the smelter, mostly by mechanical drive direct from the turbines. About 3000 kw is developed on the opposite side of the river in the station of the Montana Power Company by two Leffel turbines driving two 1500-kw, 6600-volt generators, installed in 1913 to replace an accumulation of

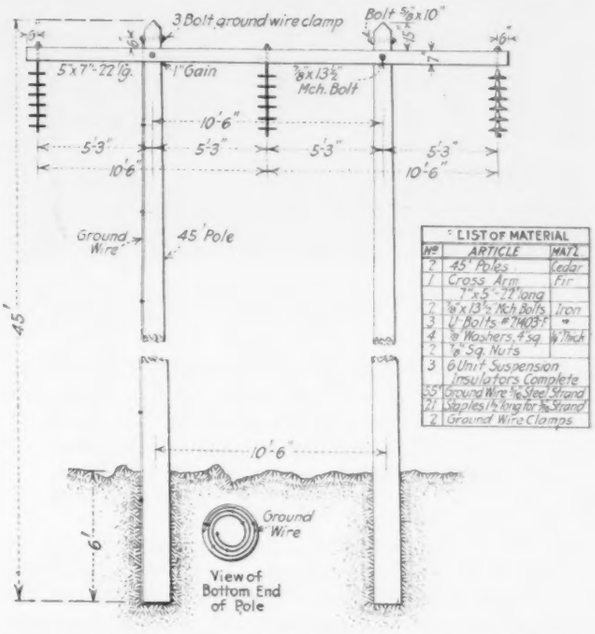


FIG. 10—DOUBLE CEDAR-POLE STRUCTURE FOR 100,000-VOLT LINE

old-style turbines and belt-driven generators which served the city of Great Falls. Owing to the limited pond area some trouble is experienced during a few days of each winter from frazil ice. The plants are usually kept in operation during these periods by the use of steam pipes at the intake screens, and by detailing a crew of men to pull ice through waste gates.

Rainbow Falls Station

The Rainbow dam is a rock-and-concrete-filled, timber-crib structure 26 ft. high with an 1140-ft. spillway equipped with 10 ft. of removable flashboards. There are also sluicegates to assist in regulating the flow of the river. A feature of this dam is the arrangement of the timber in the cribs, the timbers being set approximately at right angles to the resultant thrust line instead of in a horizontal plane.

At one end of the dam water is admitted to an open intake forebay from which two 15½-ft. steel conduits

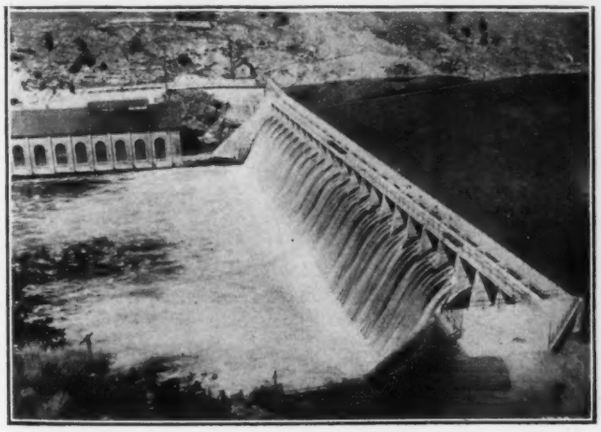


FIG. 9—HAUSER LAKE DAM OF THE MONTANA POWER COMPANY

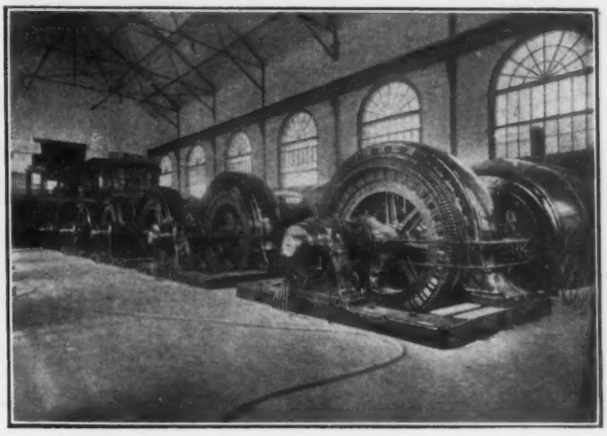


FIG. 11—INTERIOR OF HAUSER LAKE PLANT—ORIGINAL FIVE 2800-KW UNITS

FIG. 12—GREAT FALLS SMELTER, ANACONDA COPPER MINING COMPANY—POWER HOUSE IN FOREGROUND

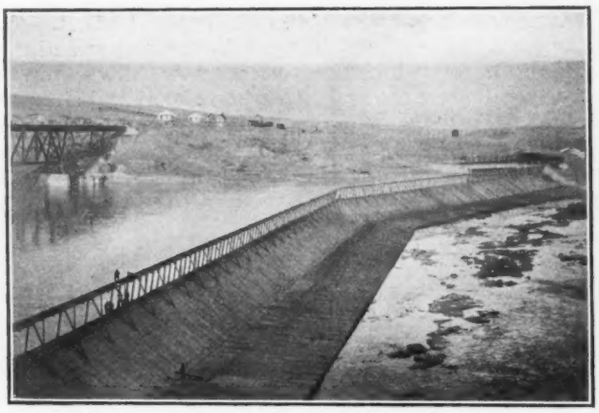


FIG. 14—RAINBOW DAM, SHOWING STEEL FLASHBOARD SYSTEM AND FOOTBRIDGE

conduct the water to a regulating reservoir. From here it passes through twelve 8-ft. pressure pipes, about 300 ft. long, to six double-runner, cast-iron, scroll-case S. Morgan Smith turbines, directly coupled to six 3500-kw, 6600-volt General Electric generators. An 1100-ft. tailrace, excavated through solid rock, conveys the water to the river below the falls.

The total head of 107 ft. is produced by a dam 26 ft. high, Rainbow Falls (35 ft. high), Coulter's Falls (25 ft. high), and the intervening rapids.

Just above the dam are the famous Giant Springs, which discharge about 600 cu. ft. of water per second at a steady temperature of 56 deg., and thus effectively prevent troubles from frazil and floating ice.

The duplicate 102,000-volt transmission lines are 130 miles long and transmit nearly the entire output to Butte and Anaconda, where it is used mostly for mining and smelting purposes. About 3000 hp is also transmitted at 6600 volts to the Boston & Montana smelter at Great Falls, and in addition an extra 3600-kw bank of transformers serves several long distributing lines to the Sun River reclamation project, the Stockett coal mines, the Lehigh coal mines, and the cities of Havre, Lewistown and various intermediate towns. These lines are of the wooden-pole suspension-insulator type, with 350-ft. standard spans on 45-ft. poles. They were designed for 88,000 volts, and have four 10-in. units of Ohio Brass insulators and three No. 8 copper wires for each conductor. A single ground wire of three No. 9 steel wires is carried on the top cross-arm.

Outdoor substations are used in all cases for ratings up to 750 kw, and are operated without regular attendance.

Other Water-Power and Steam Plants

The other plants of the system at present in operation are relatively small developments. It may be noted, however, that the connection of such plants as the Billing, Livingston and Lewistown plants with the general system makes it possible to operate them either at maximum output continuously or to close them down entirely, according to the needs of the system as a whole, thus not only insuring better service to local customers but making the operation of the plants more efficient and the unit cost of production cheaper.

The Butte steam plant is a modern type of steam station containing 3200 hp of Babcock & Wilcox water-tube boilers served by automatic stokers, which supply steam to two Westinghouse-Parsons turbines, each driving two 2000-kw, 2400-volt generators. Condensing water is cooled by a natural-draft cooling tower. Since the physical consolidation of the various transmission systems serving Butte it has not been necessary to keep the plant under steam, so that it serves at present merely as a reserve to carry load increases which may come on before the completion of new generating stations and for similar emergency use.

The Hebgen Reservoir

The Missouri River is formed at Three Forks by the junction of the Gallatin, Madison and Jefferson Rivers.

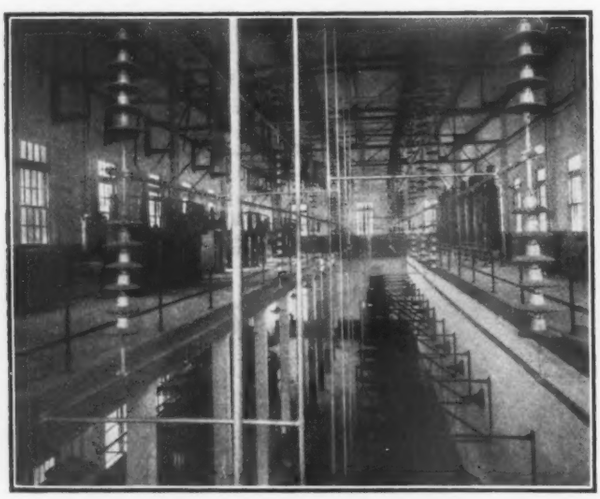


FIG. 13 — INTERIOR OF RAINBOW SUBSTATION, SHOWING IRON-PIPE BUSBARS FOR 100,000 VOLTS

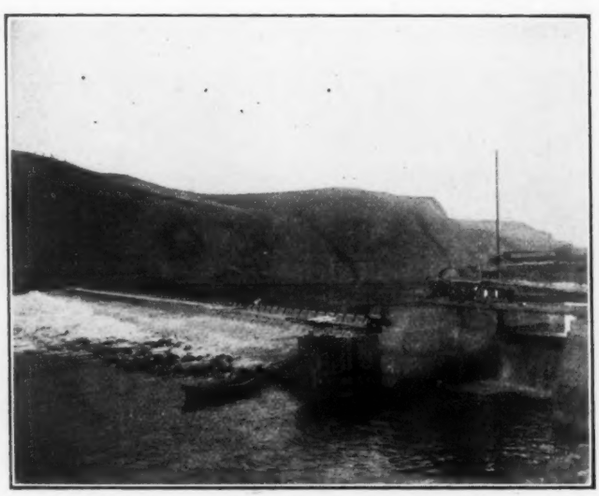


FIG. 15—DAM AND SLUICEGATE, BILLING PLANT NO. 1, ON YELLOWSTONE RIVER

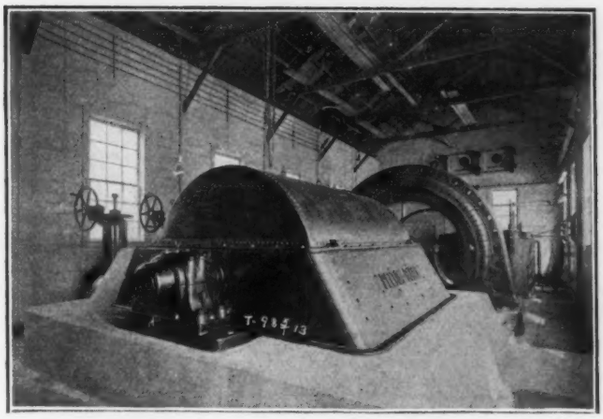


FIG. 16—PROSPECT CREEK PLANT OF THOMPSON FALLS POWER COMPANY—750-KW UNIT

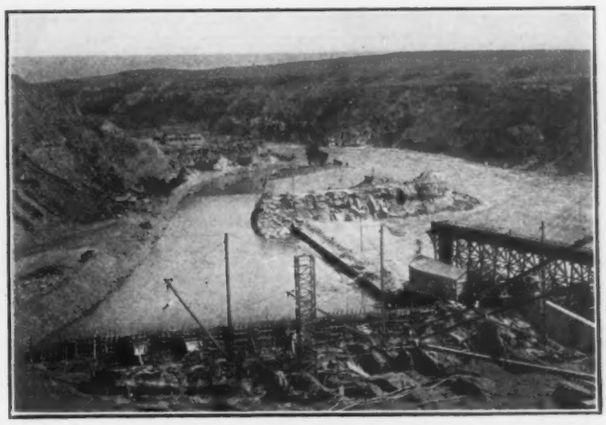


FIG. 18—GREAT FALLS DEVELOPMENT—TAILRACE, LOOKING DOWN-STREAM

Of these the Madison has the largest and steadiest flow. On the headwaters of the Madison River adjacent to the northwest corner of Yellowstone Park the Montana Reservoir & Irrigation Company is now completing a dam which, when finished, will impound the Hebgen Reservoir, a lake of 13,000 acres with a shore line of 65 miles and an available storage capacity of 325,000 acre-ft. The drainage area is 900 sq. miles and the precipitation in this altitude is upwards of 30 in., so that the reservoir can be filled during each normal spring flood and partially refilled during the succeeding autumn rainy season.

The dam is a very substantial earth embankment 600 ft. long, 107.5 ft. high from bed rock, and 87.5 ft. above original river level, with a concrete core wall 16 ft. thick at the base and 3 ft. thick at the top. The outlet is through four openings into a concrete tower controlled by stop logs. These stop logs are handled by an electric crane.

This reservoir will serve the double purpose of storing water for use in various gravity irrigation projects now under consideration and of furnishing both the water and the power for several irrigation pumping projects.

The first irrigation pumping project, which has already been in operation for two seasons, is the Prickly Pear unit No. 1 in the valley adjacent to Helena. In this plant are installed three 600-hp motors driving nine centrifugal pumps each of 10 second-ft. capacity. These pumps deliver water through wood-stave pipes to three main canals, respectively 75 ft., 110 ft. and 150 ft. above the level of Hauser Lake, from which the supply of water is drawn. These ditches serve 6000 acres of land, at a total uniform cost to the farmer of $1.75 per acre-ft., which charge includes all expenses up to the farmer's turnout.

A second pumping plant, recently completed, in the same district has a motor rating of 2000 hp and will deliver water to a maximum height of 174 ft. It will ultimately serve a somewhat larger acreage than the first unit.

Great Falls Development

In order to carry the rapidly increasing load of the system and to provide for the operation of 452 miles of the main line of the Chicago, Milwaukee & St. Paul Railway, which crosses three mountain ranges within

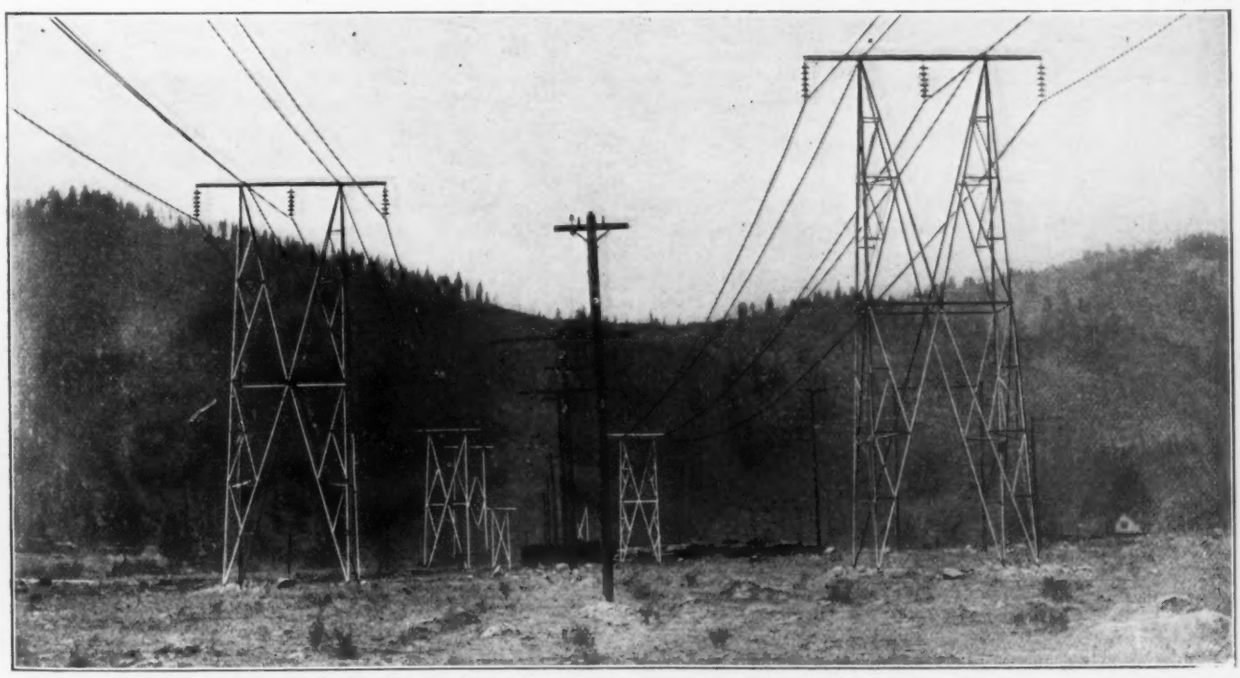


FIG. 17—STRAIGHT-LINE CONSTRUCTION IN ROUGH COUNTRY—100,000-VOLT TRANSMISSION LINE OF GREAT FALLS POWER COMPANY

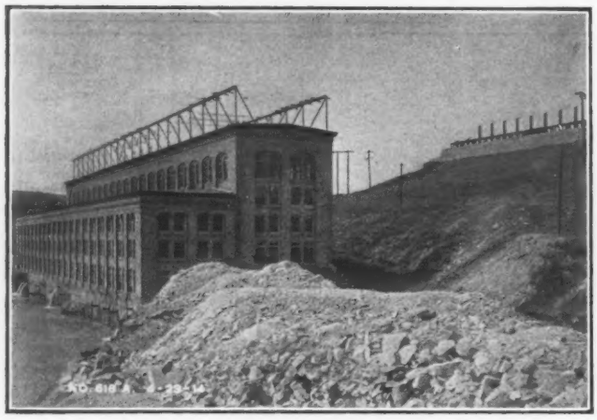


FIG. 19—RAINBOW PLANT, NEAR CITY OF GREAT FALLS; TOTAL RATING, 25,000 KW

FIG. 21—CROPS GROWN ON LAND IRRIGATED BY ELECTRIC PUMPING

this district, there are now building two new plants which will be ready for initial operation this year. These are the Great Falls development, with 60,000 kw ultimate rating, and the Thompson Falls development with 30,000 kw. The Thompson Falls plant will be ready for operation on July 1, and the Great Falls plant on Aug. 1 of this year.

Five miles below the Rainbow development are the Great Falls of the Missouri, which in 1805, when Indians and wild game were the only inhabitants of this region, were described by Lewis and Clark, its first explorers, as a magnificent site for mills and other industries requiring large quantities of power for their operation.

The site has remained undeveloped until the present time chiefly because of its magnitude and because the lesser falls have been found to be entirely ample for past needs.

The dam is a gravity concrete section 70 ft. high, in the form of an arch of 563.41-ft. radius, and is built just above the brink of the falls. The arched plan was adopted chiefly to obtain the necessary length of spillway and to conform to the natural contour of the site, which permits the left end of the dam to curve downstream, forming a natural forebay, from which steel pressure penstocks about 300 ft. long lead directly to six 15,000-hp, 200-r.p.m., single-runner, vertical S. Morgan Smith turbines in cast-iron scroll cases. The operating head is 155 ft. The turbines will be governed by Woodward oil-pressure governors, the governor servo-motors operating in pairs directly connected to the gate-operating rings. The generators are of 10,000-

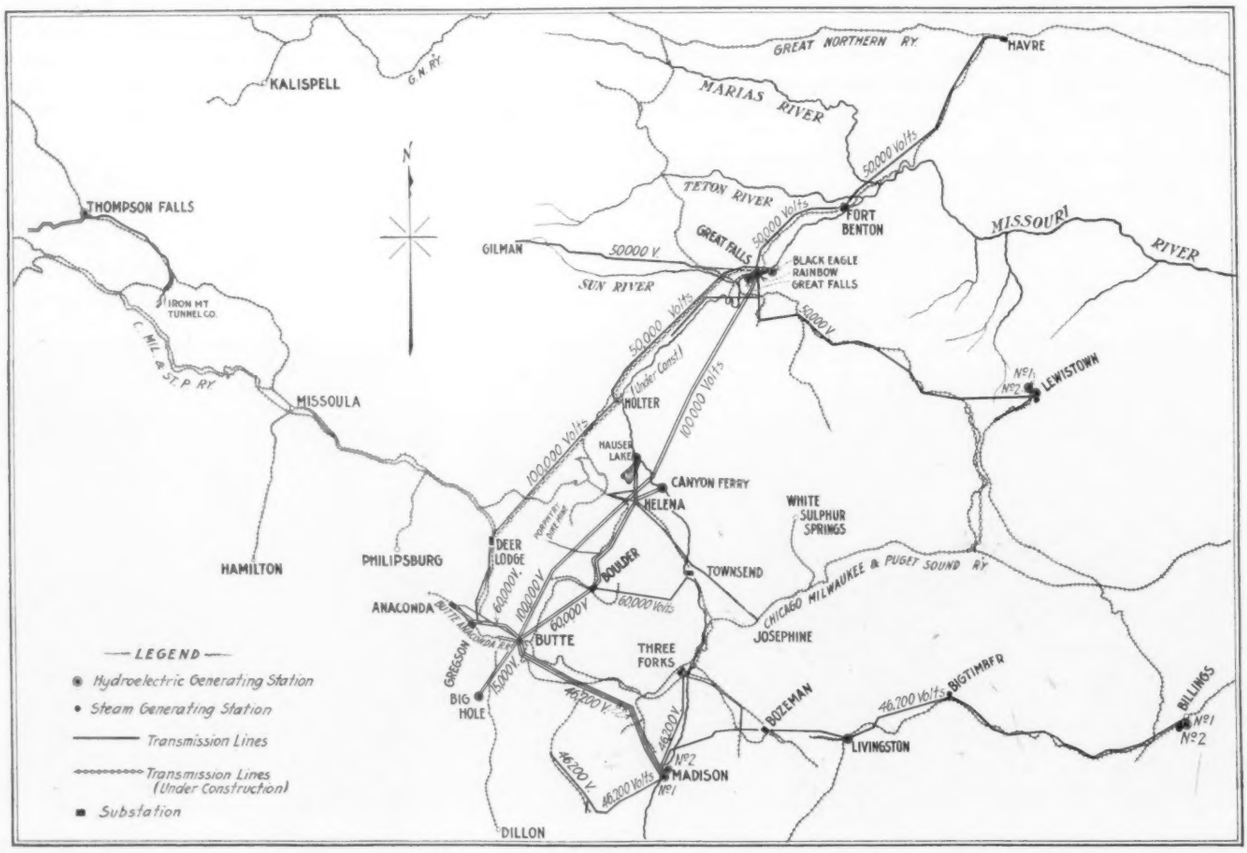


FIG. 20—MAP OF TERRITORY SERVED BY THE MONTANA POWER COMPANY AND ASSOCIATED SYSTEMS, SHOWING PLANTS AND TRANSMISSION LINES

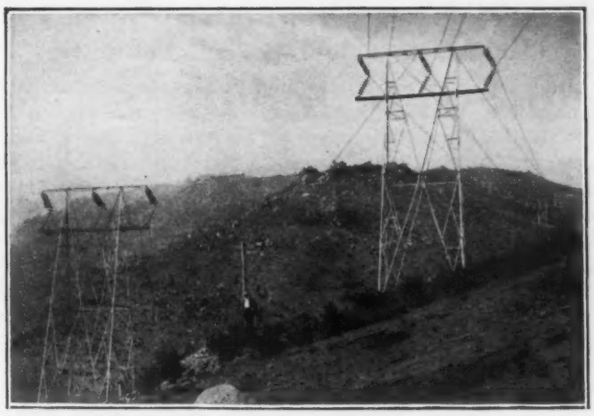


FIG. 22—ANGLE CONSTRUCTION ON 100,000-VOLT TRANSMISSION LINE

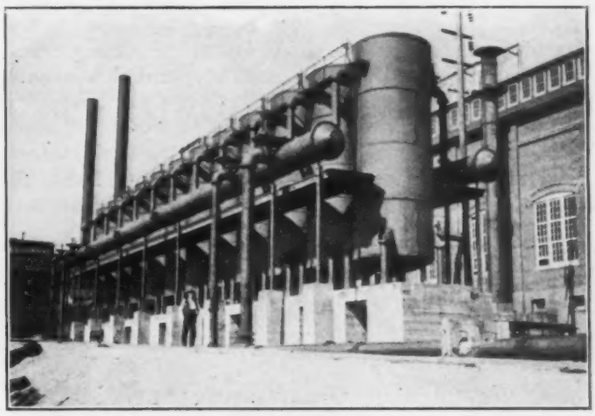


FIG. 24—RECEIVERS USED IN CONNECTION WITH AIR-HOISTING SYSTEM

kw, 6600-volt normal rating and are provided with Kingsbury bearings.

The first transmission line from this station leads to the Rainbow station. A No. 4/0 copper line, 140 miles long, supplies the Milwaukee Railroad at Morel. For these lines double-pole bridge-type support has been adopted, in preference to steel towers, after careful comparison of both first cost and maintenance cost of the two types. It should be borne in mind that poles of excellent quality are relatively cheap in western Montana, while freight charges add a heavy burden to the cost of steel towers.

Thompson Falls Development

The western end of the electrified section of the Milwaukee Railroad extends as far as Avery, Idaho. In the vicinity of this section was found an excellent water-power site on the Clark's Fork of the Columbia River at Thompson Falls. At this point the river falls approximately 20 ft. in two separate falls and has a minimum flow of 6500 cu. ft. per second. The maximum recorded flow is about 120,000 cu. ft. per second, but the dam is being designed to care for over 200,000 second-ft. The total head developed by the dam and the falls together is 55 ft. The dam is surmounted by a steel flashboard system designed to maintain the pond at an elevation of 16 ft. above the crest.

The power-house equipment will consist of six single-runner vertical turbines driving 5000-kw, 6600-volt generators. The draft tubes are molded in concrete and discharge into a natural channel which opens into the main river below the lower falls. The general plan of the power house and switching arrangement is practically a duplicate of the Great Falls development.

Butte the Center of the System

The common point of interchange between the various generating stations described is at Butte. Here there are three separate substations, one receiving energy at 70,000 volts from Canyon Ferry and Hauser Lake, one receiving power at 100,000 volts from Rainbow Station, and one receiving power at 15,000 volts and 46,200 volts from the Big Hole plant and from plants on the Madison River system. The first two substations are connected by a very heavy 2400-volt tie bus. An extension of the 46,200-volt transmission line from the third substation connects to a 7200-kw bank of transformers in the second substation, thus tying this system to the 2400-volt tie bus.

Certain of the loads in the Butte mining district, such as mine pumps and air compressors, which supply the hoisting engines, are connected directly to this tie bus, while other loads in each station are connected to the station end of the bus.

Reverse-current and overload circuit-breakers are so arranged that in case any one of the three main substations suffers a serious interruption of its own transmission lines the less important load will automatically trip off with the substation which is in trouble, leaving the more important load to be served by the remaining transmission lines without interruption. This system has worked so well in practice that electric mine pumping and hoisting has become well nigh the universal method in the Butte mines.

Compressed-Air Hoisting at Butte

An interesting system of hoisting by compressed air has been developed by the Anaconda Copper Mining Company, which has installed seven 1200-hp synchro-

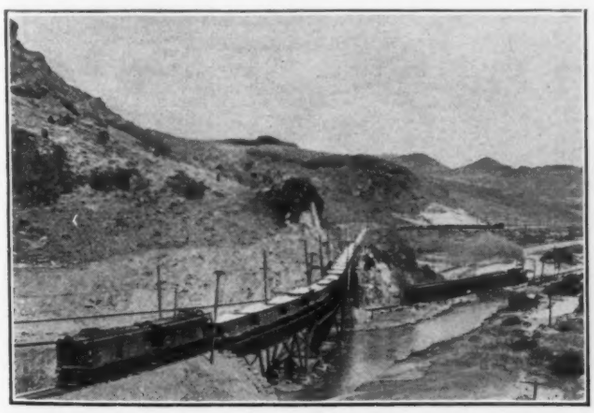


FIG. 23—TRAIN LOADED WITH ORE ON BUTTE, ANACONDA & PACIFIC RAILWAY

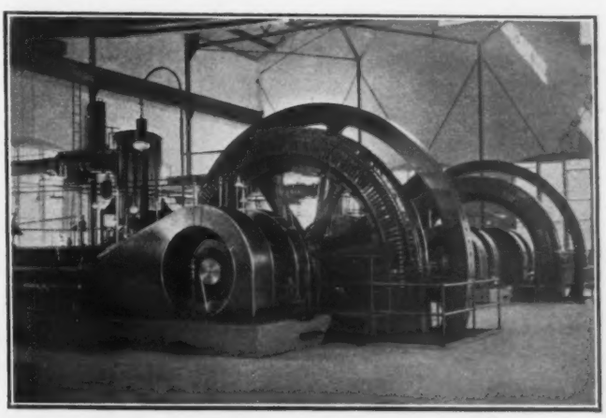


FIG. 25—1200-HP SYNCHRONOUS MOTOR-DRIVEN AIR COMPRESSORS SUPPLYING HOISTS

nous motors driving air compressors for this purpose alone. These air compressors are operated at nearly 100 per cent load-factor. A very large air storage is provided in the form of tanks at the foot of a hill about 220 ft. high, from which connections at the tank bottoms are led to a reservoir of water at the top of the hill. The water automatically displaces the air or is displaced

FIG. 26—SIX 3500-KW UNITS IN RAINBOW PLANT

by the air, according to the momentary requirements for air, the pressure being maintained nearly constant throughout the full range of capacity of the storage tanks. Excess air generated by this plant is allowed to pass through a differential valve into the air systems which supply drills in the mines. Air for other mine uses is also compressed electrically.

Butte-Anaconda 2400-Volt Freight Road

Another load of considerable interest at the present time is the Butte, Anaconda & Pacific Railroad, which hauls about 12,000 tons of ore daily from Butte to Anaconda, in addition to considerable freight and passenger service. As already described in these columns,

GENERATING STATIONS OF MONTANA POWER COMPANY AND INTERCONNECTED SYSTEMS

Plants	Available Storage, Acre-feet	Rating in Kw	Operating Head in Feet
Operating:			
Hebgen dam	325,000	(Storage only)	
Madison No. 1	.....	2,000	60
Madison No. 2	40,000	9,000	110
Big Hole	1,250	3,000	64
Canyon Ferry	40,000	7,200	35
Hauser Lake	54,000	17,500	65
Black Eagle	.....	3,000	43
Rainbow	1,200	25,000	110
Billings No. 1	.....	980	18
Billings steam	.....	500	.....
Livingston	.....	1,500	24
Lewistown No. 1	.....	350	62
Lewistown No. 2	.....	100	.....
Lewistown steam	.....	250	.....
Phoenix steam	.....	450	.....
Prospect Creek	.....	750	200
Butte steam	.....	4,000	.....
Total	461,450	75,580	
Under construction:			
Great Falls (ready Aug. 1, 1915)	6,500	60,000	155
Holter	56,000	30,000	120
Thompson Falls (ready July 1, 1915)	5,000	30,000	55
Total in service and under construction	528,950	195,580	

2400-volt direct current is supplied to the railway trolley from substations in Butte and Anaconda. The distance between substations in 23 miles, but no intermediate substations are necessary at this voltage.

Plans of the California Joint Committee

Interesting work is planned for a joint committee which has been appointed from the membership of the California associations of electrical jobbers, dealers and contractors, as set forth in detail in a pamphlet recently published by the California Association of Electrical Contractors and Dealers. It is called "Co-operation Between Electrical Contractors and Jobbers—What It Means to You." This pamphlet calls particular attention to the need for improving the state of electrical construction on the Pacific Coast and the importance of obtaining the support of architects and non-member contractors.

Through this joint committee the jobbers and contractors hope to promote the use of electrical appliances and to influence the public to adopt the idea—"Do it electrically." The committee will visit all parts of the State, holding public lectures supplemented by motion pictures, stereopticon views and working demonstrations of electrical appliances. The committee will ascertain the names of all societies of architects and the time and place of their meetings, and will endeavor to have representative electrical engineers as well as members of the committee appear before the associations to explain the necessity for the proper drawing of plans and their compliance with recognized modern electrical specifications. By proper co-operation on the part of the architects and other allied interests, it is believed that the various State associations of electrical contractors will ultimately be able to guarantee on behalf of their members the completion of any contract entered into. The aim of the committee will be to promote the best practice in electrical construction, and it will attempt to introduce the best standards of material.

Dredging with Electricity in Idaho

The use of Bear Lake in southern Idaho as an equalizing storage reservoir for the hydroelectric properties of the Utah Power & Light Company in Idaho and Utah has been made possible by building a system of dikes, inlet and outlet canals and control gates. In the accom-

ELECTRIC DREDGING—BEAR LAKE RESERVOIR

panying illustration is shown an electrically operated 20-in. suction dredge excavating the long outlet canal from the lake to the Bear River. The hydraulic dredge is operated by electric motors having a combined rating of 1000 hp. The energy for the motors is supplied from the high-tension lines shown in the picture, through the floating substation seen at the left of the dredge.

A 200-Mile Artificial Transmission Line

Utility of Such Laboratory Structures Both for Purposes of Instruction and in Research Work

BY C. EDWARD MAGNUSSON, J. GOODERHAM AND R. RADER

IN most engineering schools the instruction on electrical energy transmission lines is given by lectures, textbooks and classroom problems. Practically no laboratory work is offered, for the simple reason that the instructors have no long transmission lines at their disposal. In the telephone field artificial lines are in common use both in the college laboratory and by the practical telephone engineer. It is, however, only within the past four years that any extended experiments have been made with artificial transmission lines in order to compare experimental observations with theoretical calculations. Investigations of great value have recently been made at Union College,[1] under the direction of Dr. Steinmetz, and by Dr. Kennelly[2] at Harvard University. The results give conclusive evidence that the electrical phenomena of commercial transmission lines can readily be reproduced by artificial lines in the laboratory. Very little, if any, attention has been given to the problem of providing for the undergraduate adequate laboratory facilities for experimental work on transmission-line phenomena. Both the lines referred to above were designed for special research work, whereas instructional work requires apparatus of a more general nature.

[1] *Trans. A. I. E. E.*, Vol. XXX, page 87, by J. H. Cunningham. *Trans. A. I. E. E.*, Vol. XXXI, page 887, by J. H. Cunningham and C. M. Davis.

[2] ELECTRICAL WORLD, Feb. 17, 1912, page 359, A. E. Kennelly and H. Tabossi. *Trans. A. I. E. E.*, Vol. XXXI, page 1131, A. E. Kennelly and F. W. Lieberknecht.

Some of the characteristics of the two lines referred to may be noted:

Artificial Line at Union College.—The line has 400 units. Each unit consists of No. 8 B. & S. copper wire, wound spirally on a glass cylinder, 6¼ in. (15.8 cm) in diameter and 5 ft. (1.52 cm) long. Each unit represents 0.325 mile (0.52 km) of line.

The inside of the glass cylinder is coated with tinfoil.

The line has a total resistance of 93.6 ohms, a total inductance of 0.394 henry, and a total capacity of 1.135 microfarads.

Equivalent length of line, 130 miles (230 km).

Equivalent size of wire, No. 1 B. & S. copper.

Equivalent spacing, 72 in. (182 cm).

A very desirable feature of the design is the uniform distribution of resistance, inductance and capacity.

This line has the undesirable features of high first cost and maintenance cost. It is also limited to one size of wire and one spacing, as the resistance, inductance and capacity are fixed for each unit.

Artificial Line at Harvard.—This line has thirty units. Each unit consists of four induction coils and one condenser, the coils being wound with No. 19 B. & S. copper wire. Each unit represents 50 miles (80 km) of line.

The line has a resistance of 726 ohms, a total inductance of 2.7 henries, and a total capacity of 2.25 mfd.

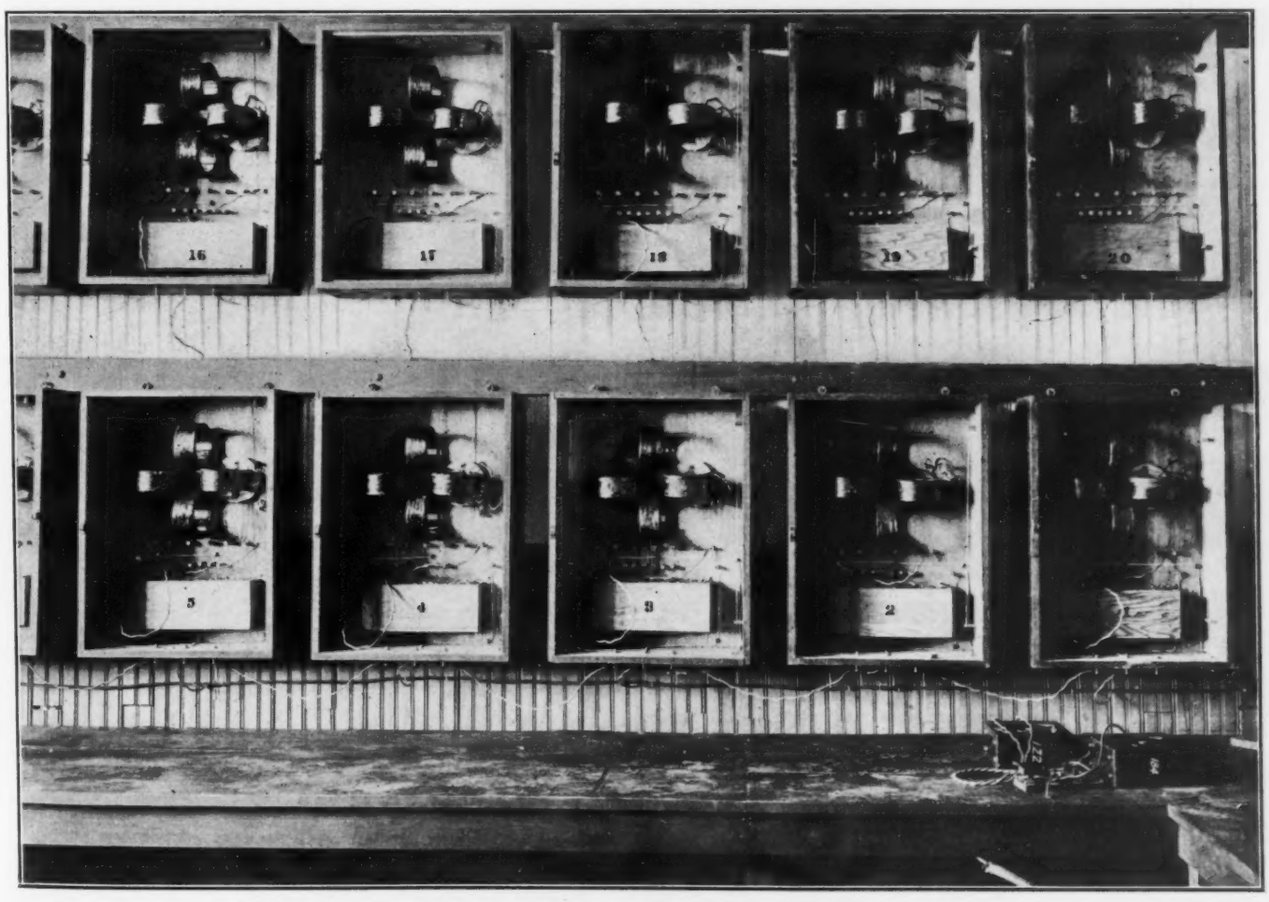


FIG. 1—ARTIFICIAL LINE SHOWING TEN OF TWENTY UNITS

Equivalent length of line, 1500 miles (2400 km).
Equivalent size of wire, No. 3/0 B. & S. aluminum.
Equivalent spacing, 90.5 in. (230 cm).

The line is of the lumpy type, with resistance as the only adjustable line constant. This line has low first cost and the maintenance is small. It was designed for special investigations under such conditions that the wave-length of the waves studied would be large in comparison to the equivalent length of each unit. For giving an accurate representation of present-day commercial transmission lines, 50-mile units are too large.

Artificial Line at Massachusetts Institute of Technology[3].—This line has thirty units. Each unit has eight induction coils, of No. 12 B. & S. copper, and one condenser.

Equivalent length of each unit, 30 miles (48 km).
Equivalent size of wire, 500,000 circ. mils copper.
Equivalent spacing, 108 in. (275 cm).

The construction is similar to that of the Harvard line.

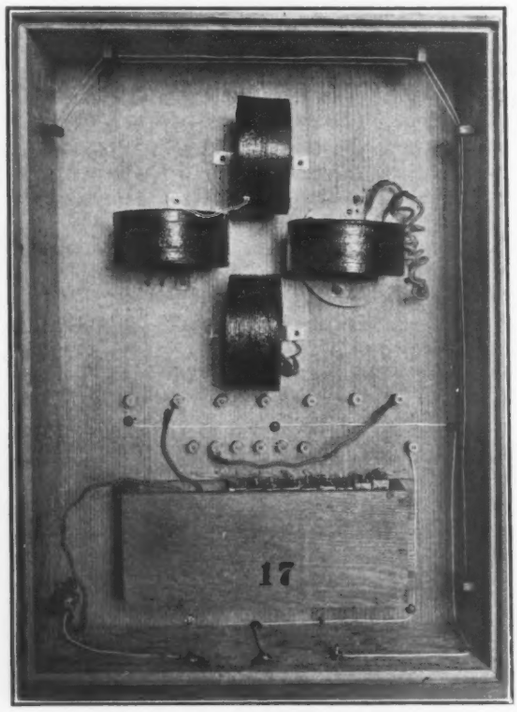


FIG. 2—A TEN-MILE UNIT

Artificial Line at the University of Washington.—The investigation described in this paper was made for a twofold purpose: First, to design and construct an artificial transmission line suitable for laboratory experiments for undergraduate students, and, second, to provide the first part of the apparatus required for research on long-distance transmission problems. Fig. 1 is a photograph of the line constructed.

For instructional purposes it is desirable to have a line adjustable in length, spacing and size of wire, so as to be comparable with a large number of commercial transmission lines. The requirements of low first cost and minimum maintenance are met by the "lumpy" type of line. A 10-mile unit was deemed a sufficiently close approximation to the uniformly distributed inductance, capacity and resistance in practical lines, even at frequencies as high as 800 cycles per second. This line was designed to be adjustable for any spacing up to a maximum of 120 in. and for any size of wire up to No. 4/0 B. & S. hard-drawn copper.

[3]ELECTRICAL WORLD, May 2, 1914, page 980, and Aug. 8, 1914, page 278.

To comply with these assumptions each 10-mile unit should have a maximum inductance of 0.021 henry, a minimum resistance of 2.59 ohms, and an adjustable capacity from 0.1 to 1.0 microfarad.

Inductance.—The general plan of the induction coils was made similar to the Harvard line, using four short

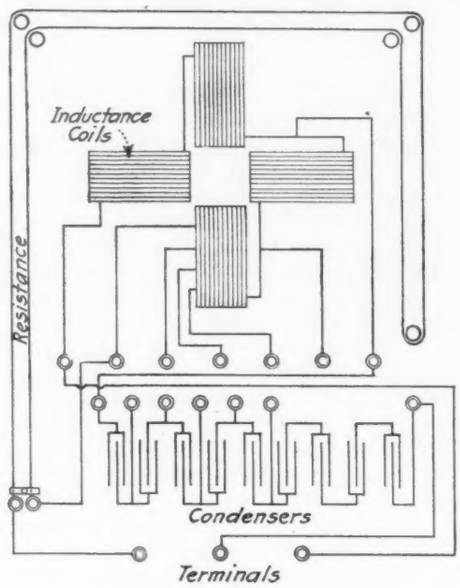


FIG. 3—WIRING OF UNIT

air-core solenoids arranged in a square. As the mutual inductance could not be determined until both the dimensions of the coils and the relative positions of the four coils on the square were known, it was omitted while making the preliminary calculation of the coil dimensions. Corrections were later applied to the number of turns, so as to give the total required inductance with the coils in position. Each coil was designed for a resistance of $2.59 \div 4 = 0.65$ ohms at 25 deg. C. and an inductance of $0.021 \div 4 = 0.00525$ henry. No. 14 B. & S. double-cotton-covered copper wire was used; this with the given resistance fixes the length of wire in each coil at 257 ft.

For a given length of wire the inductance depends on the dimensions of the coil. For short air-core solenoids the inductance is given by Brooks' formula[4], viz.,

$$L = \frac{\text{cm}^2}{l + r + 1.5c} \times \frac{F'F'''}{10^9}. \qquad (1)$$

The formula gives inductance in henries with the dimensions in centimeters. When the dimensions are

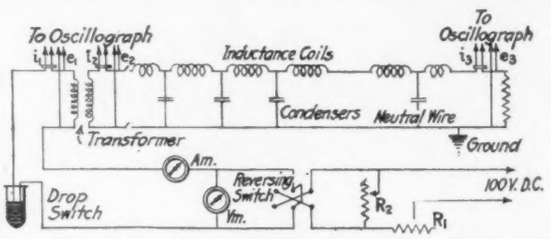


FIG. 4—DIAGRAM OF CONNECTIONS FOR TESTING A 200-MILE ARTIFICIAL TRANSMISSION LINE

in inches, multiply the right side of equation (1) by 2.54.

cm = length wire on coil.
l = length of coil.
r = mean radius of coil.
c = thickness of winding.

[4]*Bulletin* No. 53, University of Illinois.

F' and F'' are correction factors for very short coils and have the values:

$$F' = \frac{10l + 12c + 2R}{10l + 10c + 1.4R'} \qquad (2)$$

$$F'' = 0.5 \log_{10} \left\{ 100 + \frac{14R}{2l + 3c} \right\}, \qquad (3)$$

where R = outside diameter of coil.

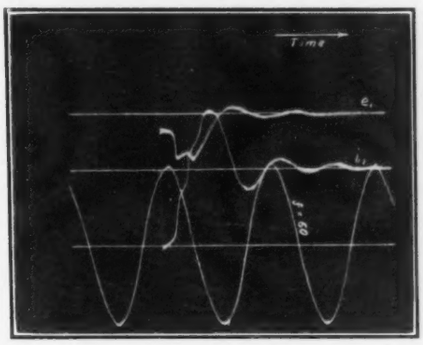


FIG. 5—RECEIVER END OPEN. e_1 = VOLTAGE AT GENERATOR END. i_1 = CURRENT AT GENERATOR END. f = SIXTY-CYCLE WAVE

With the length of wire given the volume of the coil is a constant. The volume may be expressed in two ways, viz.,

$$\text{Volume} = 2\pi rlc = \frac{\pi d^2}{4} \text{ cm}, \qquad (4)$$

where d = diameter of wire over insulation. Whence

$$l = \frac{d^2 \text{cm}}{8rc}. \qquad (5)$$

For the given size of wire (No. 14 B. & S. double-cotton-covered, for which $d = 0.072$ in.) and length of wire (257 ft.), both d and cm are fixed. The number of layers fixes c. Consequently, for any assumed value of r and number of layers, l is fixed by equation (5), and therefore L is fixed by equation (1). Curves may therefore be plotted giving the relation between the mean radius of the coil and the inductance for various numbers of layers, and the proper number of layers and

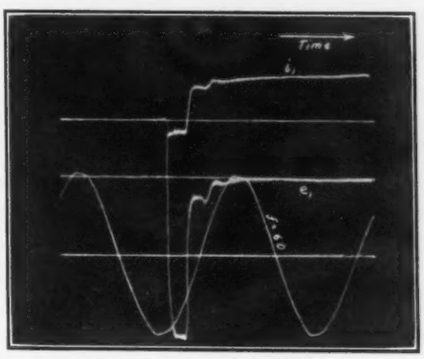


FIG. 6—RECEIVER END SHORT-CIRCUITED. e_1 = VOLTAGE AT GENERATOR END. i_1 = CURRENT AT GENERATOR END. f = SIXTY-CYCLE WAVE

mean radius for the given value of L (= 0.00525 henry) chosen from these curves.

By this method it was found that an eight-layer coil of approximately 2.2 in. (5.6 cm) mean radius gives the required inductance of 5.25 millihenries. The corresponding length of coil is, then, from (5), 2.10 in. (5.34 cm) and the thickness of winding $8 \times 0.072 = 0.58$ in. (1.48 cm).

Four test coils were made of these dimensions and the inductance of each was measured. The four coils were then arranged in a square, as shown in Fig. 2 and connected in series. The mutual inductance was found to be approximately 8 per cent of the total self-inductance. Compensation for the mutual inductance was secured by reducing the length of the wire 7 ft., thus reducing the inductance by $7^2 \div 257^2 = 7.8$ per cent.

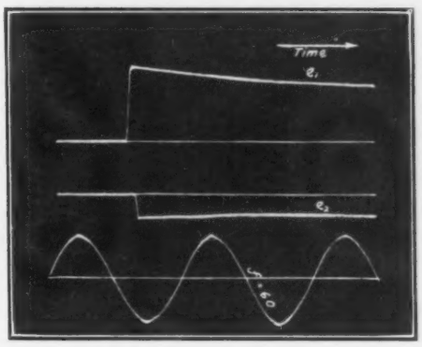


FIG. 7—RECEIVER END CONNECTED THROUGH A RESISTANCE EQUAL TO $\sqrt{L \div C}$ OHMS. e_1 = VOLTAGE AT GENERATOR END. e_2 = VOLTAGE AT RECEIVER END.

The final dimensions of the coils as constructed were: Mean radius, 2.2 in. (5.59 cm); length of coil, 2.15 in. (5.47 cm); thickness of winding, 0.6 in. (1.52 cm); number of turns, 216 (eight layers of twenty-seven turns each); length of wire, 250 ft. (76.3 m).

The constants for the completed coil were: Inductance, computed, 0.00477 henry; measured, 0.00483 henry. Resistance, computed, 0.643 ohm; measured, 0.650 ohm at 25 deg. C.

It may be noted that the measured inductance is 8 per cent less than the 0.00525 henry required. This difference is supplied by the mutual inductance between the four coils in each unit. With the four coils in position the measured inductance closely approximates the required amount.

After completing the winding, the coils were baked in "condensite enamel" to exclude moisture and to increase the insulation. The baking was done in a steam-jacketed cylinder in the following manner: After placing the

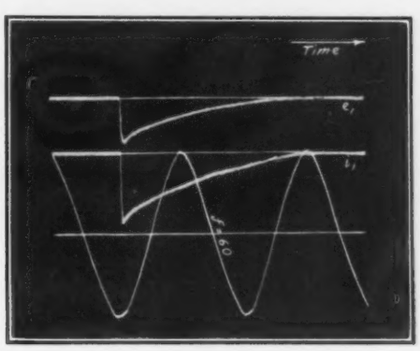


FIG. 8—RECEIVER END CONNECTED THROUGH A RESISTANCE EQUAL TO $\sqrt{L \div C}$ OHMS. e_1 = VOLTAGE AT RECEIVER END. i_1 = CURRENT AT RECEIVER END.

coils in the cylinder, a vacuum of 8 lb. and a temperature of 112 deg. C. was maintained for two hours. Sufficient condensite enamel to cover the coils was then forced into the cylinder by means of the outside atmospheric pressure. Next a pressure of 120 lb. per sq. in. was applied inside the cylinder and maintained for two hours with the temperature at 112 deg. C. The free liquid was then removed and the coils baked for ten

hours at 112 deg. C. and at a pressure of 120 lb. per sq. in. This process produced a hard and solid coil with a glossy surface.

Capacity.—Ordinary paraffin-paper telephone condensers, 1 in. by 2 in. by 4½ in., were used. Each condenser was tested for 500 volts and had a capacity of 1 microfarad. Nine of these condensers were provided for each unit, arranged as shown in Fig. 3. The receptacle for the condensers has space for four additional condensers.

Resistance.—An adjustable resistance was provided by a loop of No. 21 "Advance" resistance wire, arranged as shown in Fig. 3. Each unit was supplied with a 50-ohm manganin resistance to be inserted when it is desired to change the line into a telephone circuit.

The 10-Mile Unit.—The assembled unit is shown in Fig. 2 with the cover removed and the corresponding wiring diagram in Fig. 3. The right-hand coil is placed on a movable base, so that the coil can be turned 180 deg., thus varying the mutual inductance. Three taps are provided on the lower coil, dividing the number of turns into four equal parts. The average resistance of

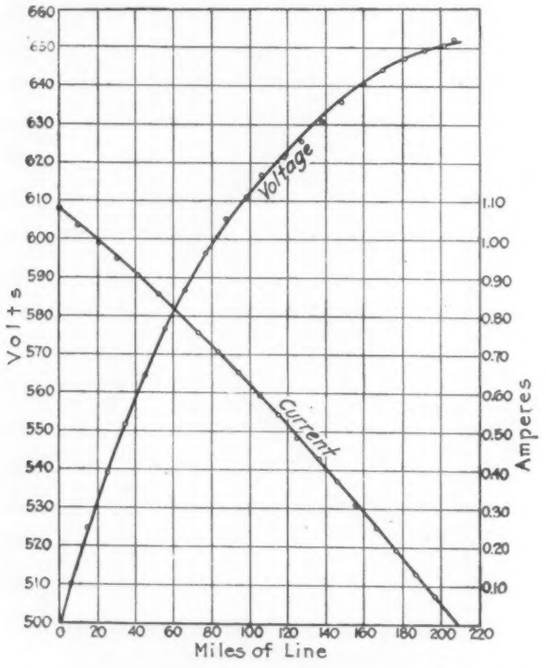


FIG. 9—VOLTAGE AND CHARGING CURRENT AT NO LOAD, FREQUENCY 100 CYCLES

the twenty units is 2.581 ohms at 25 deg. C., the resistance per unit ranging from 2.467 to 2.630 ohms. The average inductance of the units (each arranged for maximum inductance) is 0.0213 henry, the inductance per unit ranging from 0.0197 to 0.0220 henry. The average capacity of the twenty units (eight condensers in series in a unit) is 0.147 microfarad, the capacity ranging from 0.142 to 0.158 microfarad.

The variation in the inductance of each unit which can be obtained by rotating the movable coil and by using the taps on the lower coil is shown in Table I.

Two-Hundred-Mile Line.—Half of the complete line is shown in Fig. 1. The twenty units are connected in series. In a "lumpy" line the capacity connection can be made either on one side or at the middle point of the inductance in each unit. The two arrangements are termed the "Π" and the "T" connections respectively. In the tests described below the "T" connection was used (see Fig. 4).

As a check on the design, the twenty units were connected in series and adjusted to represent 200 miles of No. 4/0 B. & S. copper 120-in.-spacing, one-phase, grounded, Y-connected, transmission line. The calculated constants of such a line are compared in Table II with the measured constants of the artificial line above described.

The apparatus can be adjusted so as to represent either aerial or cable, energy or telephone lines for a wide range of spacing and size of wire.

TABLE I—INDUCTANCE OF 10-MILE UNIT

Position of Rotating Coil	Coils in Series				
	4	3¾	3½	3¼	3
0 deg.	0.0214	0.0193	0.0176	0.0161	0.0154
45 deg	0.0209	0.0186	0.0167	0.0156	.....
90 deg.	0.0199	0.0178	0.0160	0.0149	.....
135 deg.	0.0188	0.0171	0.0158	0.0145	.....
180 deg.	0.0185	0.0168	0.0152	0.0142	.....

Traveling Wave and Length of Line.—Fig. 4 shows the connections used for taking oscillograms of traveling impulses. The impulse is produced by suddenly opening the drop switch, the arrangement being similar to that used by Cunningham and Davis[5] in their experiments on the Union College line. Time was measured by taking an oscillogram of a sixty-cycle voltage wave simultaneously with the oscillograms of the impulses.

The line constants were adjusted to the following values: Inductance, 0.47 henry; capacity, 2.92 microfarads; resistance, 51.7 ohms; quarter-wave-length frequency $= 1 \div (4\sqrt{LC}) = 893$ cycles per second; equivalent length = 209 miles (336 km) of single wire; equivalent spacing = 120 in. (305 cm) No. 4/0 B. & S. copper.

Four oscillograms are shown, the conditions under which each was taken being stated immediately beneath the oscillogram. These oscillograms are similar to those obtained on the Union College line and need no extended description.

From measurements of the time elapsed between the beginnings of the two voltage waves in Fig. 7, and the time in Fig. 6 taken by the impulse to travel out to the end of the line and back again, the length of the line was calculated and found to be 214 miles (344 km). This differs by 2.4 per cent from the value calculated from the line constants.

Voltage and Current Readings at 10-Mile Intervals.—To determine accurately the magnitude and phase relations of the voltage and current along such an artificial line as above described requires an alternating-current potentiometer. When this piece of apparatus is not available, approximate readings may be obtained by using ordinary alternating-current ammeters and voltmeters. The data given in Table III were obtained by using a Weston voltmeter, model 18, with multiplier,

TABLE II—COMPARISON OF CALCULATED AND MEASURED CONSTANTS

	Calculated for Actual Line	Measured Artificial Line
Total resistance	51.80 ohms	51.80 ohms
Total inductance	0.42 henry	0.42 henry
Total capacity	2.86 microfarads	2.90 microfarads

[5] *Trans. A. I. E. E.*, Vol. XXX, page 887, J. H. Cunningham and C. M. Davis.

and Weston ammeters, model 155. The line was connected in "T" and the constants and equivalent lengths were the same as above, giving an equivalent to 209 miles of single wire. The receiver end was open and the voltage at the generator end was kept constant at 500 volts, 100 cycles. The line was very sensitive to changes in frequency, and special care was necessary in order to obtain consistent readings. The generator gave very nearly a pure sine wave. Voltage readings were taken at the middle point of each unit—i. e., across each set of condensers—and current readings were taken by inserting the ammeter between the units. The values of voltage and current are plotted in Fig. 9.

As a check on the observed values the receiver voltage

TABLE III—VOLTAGE AND CURRENT VALUES

Voltage		Current	
Receiver end	651.5	Between:	
Unit 20	650.5	20–19	0.063
Unit 19	649.5	19–18	0.124
Unit 18	647.0	18–17	0.184
Unit 17	644.0	17–16	0.244
Unit 16	640.0	16–15	0.305
Unit 15	635.0	15–14	0.362
Unit 14	630.0	14–13	0.420
Unit 13	625.0	13–12	0.480
Unit 12	618.5	12–11	0.542
Unit 11	613.0	11–10	0.598
Unit 10	609.0	10– 9	0.650
Unit 9	604.0	9– 8	0.704
Unit 8	596.0	8– 7	0.754
Unit 7	586.0	7– 6	0.802
Unit 6	576.0	6– 5	0.856
Unit 5	564.0	5– 4	0.910
Unit 4	551.0	4– 3	0.953
Unit 3	539.0	3– 2	0.99
Unit 2	525.0	2– 1	1.03
Unit 1	511.0	1 (generator)	1.07
Generator end	500.0		

was calculated from the constants of the line, assuming a uniform distribution of resistance, inductance and capacity. Neglecting the load at the receiving end due to the voltmeter, this calculated value is 653 volts. When the load due to the voltmeter is taken into account the calculated receiver voltage becomes 656 volts. Comparing this value with the observed value of 651.5 volts shows a difference between the observed and calculated values of less than 1 per cent.

The above illustrations indicate the possibilities of this type of artificial transmission line, both for giving students an insight into well-known transmission-line phenomena and for use in research work on transmission-line problems.

"White-Way" Lighting for Lowell, Mass.

Lowell, Mass., joined the "white way" procession of American cities on the evening of May 28, when 234 ornamental luminous-arc lamps of the 6.6-amp size were added to the lighting resources of the downtown district. The lamps are hung 14.5 ft. above the sidewalk, and the spacing varies from 56 ft. to 120 ft. between lamps. An unusual feature is the use of fiber tubes for covering the 10,000-volt, twin-braided No. 1 cables run inside the iron posts from the base cut-outs to the terminal blocks of the lamps. The equipment was furnished and the installation completed by the Lowell Electric Light Corporation within forty-nine working days. More than ten miles of cable and four miles of new conduit were installed by the company. The service will be paid for by the city from its street-lighting budget. Four new circuits were installed, and the company purchased four combination mercury-arc rectifiers and constant-current transformers for serving these circuits.

POLITICAL ECONOMY AND THE ENGINEER

How Engineers Can Take an Active Part in Building a Sane Public Sentiment

BY GEORGE L. HOXIE

Engineers are dependent more directly upon the workings of practical political economy than almost any other class of men. At the same time there is hardly any class of educated men who have paid less attention to economic problems than engineers: certainly, in proportion to their numbers, training and general qualifications, no class have had much less to say than engineers about what economic conditions in this country shall be. There are some indications that the situation is about to change. Is not the time ripe for engineers to work out their own theories of political economy and take an active part in a sane discussion of economic and political problems to the end that they may help to establish those conditions upon which their prosperity so vitally depends?

Engineers have already written their own systems of mathematics. They have taken mathematical tools developed by pure mathematicians, have selected certain standard and handy devices, and have put those simple tools to prosaic and practical engineering uses. Pure mathematicians may be rather shocked at times, as professional economists will no doubt be shocked, when the engineer mixes in political economy in his crude and practical way; but if the result tends toward a better popular understanding of some fundamental and elementary facts, the engineer may perhaps be pardoned.

We find a great popular confusion of ideas. "Currency," "hard money," "wealth" and "capital" are used interchangeably. Credit is measured in the same unit (dollars) and is unconsciously mixed indiscriminately with the other terms. We lose sight of the essentials—wealth, capital and the processes of their accumulation or destruction—in looking at the mere machinery—money, banking, credits, etc.—that goes with the manufacture of wealth. The situation is somewhat analogous to that existing when some great mathematical genius obscures a physical problem in page after page of symbols (mathematical machinery), when to the ordinary engineer the beginning, the process and the conclusion, if put as a modern Faraday might state it, would mean far more.

The Old Spirit of Co-operation

We have seen envy, jealousy and attack upon enterprise gradually replace the old spirit of co-operation and mutual helpfulness. The causes of such public feeling are well known, and inevitably followed certain other well-known conditions—sudden acquirement of great wealth by individuals, contrasts between the flaunting of that wealth and the bitter poverty in which great masses of people are forced to exist, etc. Along comes a wickedly false pseudo political economy and offers plausible but fallacious reasonings. The opinions and ideas of the great mass of the public are poisoned, and we have the whole economic structure of the country interfered with over a long period of years, with the resulting check to enterprise and stagnation of business now observable, but which now happily seem to be drawing to a close.

Economic discussion nowadays seems so obscured by the vernacular in which the ideas are phrased that the ordinary citizen gets little idea of what it is all about. The mere machinery of banking and trade is so complex that unless we throw away at the outset the usual language of the trained economist most of us are likely soon to be out of our depth in a maze of capital, credit, loans, rates of interest, international exchanges, etc., with the result that we may abandon all attempts to

comprehend simple, elementary and easily understood fundamentals, merely because of the complex language. Just in the same way many have been scared away from the study of simple physical phenomena by the maze of mathematical symbols in which the descriptions are sometimes obscured.

The public has been taught by editors, preachers and statesmen who ought to know better that the wealth of a reputed billionaire might be put to greatly improved uses by the owner, or by the state if it were seized; that it might be transmuted into model tenements, or hospitals, or to this or that praiseworthy object, with the result that deplorable social conditions might be greatly ameliorated. The reasoning is alluring but specious. The $1,000,000,000 is always assumed to be liquid capital, say currency, or bank deposits. A thousand dollars, say, of liquid assets, might build a decent home for a family now living in squalor. Therefore, if the $1,000,000,000 were confiscated, 1,000,000 families might be "uplifted."

No one points out that the real wealth of the billionaire is mere title holding. He may have title to factories, railroads, utility companies, houses, lands, and what not. Every one of these items is presumably kept usefully at work, at least to the extent of the owner's ability to bring this about. If any fails to serve at its full capacity at all times, it is not the title holder (owner) who mainly suffers, but factory employees and those dependent upon them, and those who have used the factory's product, or who would have sold the factory raw material, etc.

Waste of Capital

The only manner in which the title holder to vast wealth may really influence general prosperity adversely is by wasting capital in personal extravagance or by managing his capital or the income from it unwisely. The latter is the more vital. If through lack of ability, or slothfulness, or faddish notions, the physical property be not continually kept up to its maximum productiveness, if the net income be not re-invested continually in productive enterprise, it is we who mainly suffer. If the man becomes imbued with pseudo-philanthropic ideas and sincerely starts in to reform the world, it is then, and then only, that he becomes a real peril, for through his title holding he has the power to say how thousands of men, paid from his income or from exchanges of his capital, shall be employed. Such a man might tie up capital in unproductive, even though desirable, forms to a degree beyond the ability of the community to support. Such an interference with economic laws, even though it should take apparently praiseworthy forms, might conceivably work an actual net injury. That is to say, the withdrawal from production of an excessive amount of capital, even for praiseworthy purposes, might cause a greater sum total of misery than the expenditures could relieve.

Our national government, when it "improves" a useless river, is helping to cripple prosperity. When capital is given the form of a monumental post office building or railway station where a structure of an accepted business type would suffice the result tends toward the destruction of prosperity.

We are concerned with the constant production of wealth, with the conservation of wealth, and with its continual utilization to make more wealth. If a specific economic problem be stated thus: "Is it to the advantage of the community that the labor of men to the amount of so much, and the use of already created wealth to the amount of so much more, and natural resources to such and such an extent, shall be put together to produce a result which, when completed, will have the following capabilities to serve the community?" the decision becomes a matter of engineering. If engineers will get the essential elements of political economy into their subconsciousness and will start the propaganda of efficiency, conservation and economy, and above all of co-operation, the benefits are likely to be incalculable.

Problems of wealth distribution have been occupying attention to the point where wealth production has been interfered with seriously. What is now needed is a return to the old spirit of co-operation, to the notion that any and every legitimate enterprise is to be helped by every citizen to the extent of his ability. Further attack upon problems of wealth distribution may well pause until there is more to distribute.

The Promotion of General Prosperity

Engineers who are associated with regulating commissions are especially charged with the duty of practical economic study. It is particularly necessary that the initiation of a movement among regulating bodies for the promotion of general prosperity should fall to these engineers. Members of commissions are mostly lawyers, and, with some very notable exceptions, they do not have the constructive habit of thought. Such members are, for the most part, high-minded, with keen intellects, but too often they seem unconsciously to feel that mere interference is progress. The temptation is very strong for them to overstep reasonable bounds, to duplicate work already done by an operating organization, to demand statistics in such form that heavy cost is entailed, to require uneconomic service, and generally to become a burden. The engineer, if he will study practical economics, is the man who can and should minimize these tendencies.

If an appraisal is to cost, say, $100,000, the engineer might visualize the matter somewhat as follows: "This is a capital charge equivalent to $5,000 per year forever. I have it in my power to say whether ten average citizens shall be kept at work forever, in order that we, now, may know what a certain perishable property is worth. Will that knowledge enable us to save the perpetual labor of an equal, or a greater, number of men?" If the answer is no, if the result can be only to shift title to the property, the result might be not an economic benefit but a real net loss to the community.

Non-Productive Uses

A significant effect upon the prosperity of communities in a single nation follows the so-called concentration of wealth in particular localities—by which we mean not that the wealth spoken of is really concentrated, but that the men who hold titles to wealth, wherever it may happen to be, have residences in a particular neighborhood. It is important to remember the distinction, since it is made rarely, and in fact the contrary is usually assumed. The result of the concentration of residence is absentee landlordism. Additions to wealth which flow from the original properties may be shifted into investment, or extravagance, upon the judgment or whim of some rich man, instead of being used in the communities where created. Before condemning that situation, however, we must note that it is precisely such a condition that has resulted in the development of new communities. Capitalists of England, for instance, through the banking and credit systems, which we are not considering, have been able to shift the surplus products of farm, mine and manufactory, wherever situated, to America or Argentina, or elsewhere, and those surplus products have been put together there by labor similarly supported, with the resulting great additions to the wealth of the new countries that have accompanied rapid development.

The omission from consideration of banking and

credit machinery makes it relatively simple to follow great economic movements. By similar reasoning we may get some light on the shifting of property titles that accompany the great war. A good deal of misapprehension is abroad as to just what is going on, particularly as to alleged destruction of capital, which is great enough in all conscience, yet is almost negligible when compared with many estimates. Some economists seem to consider what is spent in war as equivalent to the destruction of capital in similar amount, in dollars. Then, since war is waste, it seems to follow that capital in uncountable billions is being destroyed. What is really being held up to our view, however, is the machinery through which property (capital) is being mobilized and exchanged—not destroyed. The excellence of the machinery makes the mobilization possible, but the machinery is not the mobilization.

Suppose we imagine that, instead of being plunged into war, the whole world had been thrown on Aug. 1, 1914, into such a trance-like sleep as that of the sleeping beauty and her court. We might imagine that a year later the world might have waked again and been none the wiser. The net result would have been just nothing at all, for while the world would have lost a year's growth, it would have known nothing about it.

Production and Consumption

What has actually occurred is in large part a sort of semi-cessation of activity, of production, an almost corresponding cessation of consumption, and a diversion of the activities of several millions of men from peaceful pursuits into the endeavor to kill each other. So far as considerations of property or capital are concerned, we may almost neglect the latter factor. We need only to inquire: What property existing on Aug. 1, 1914, is being, or will be, destroyed or consumed without replacement? At what rate is production going on? Is consumption proceeding at a greater rate or a less rate?

Obviously production has been greatly reduced; much production that remains is of materials economically useless (war materials). It is not so obvious that consumption has been or will be reduced in almost the same ratio. Let us consider the principal items—food and clothing. Except for reserve stocks, which are not very great in comparison with annual consumption, the only sources of food and clothing are found in production, and if consumption be not reduced in the same ratio as production, starvation or freezing of the consumers will so reduce it presently. The reduced production will then exactly supply the reduced consumption, and while want, misery, and perhaps starvation will accompany, after the reserve stocks have been used up there will be no net change in the world's wealth from this cause.

Now as to the actual destruction of fixed capital which was in existence on Aug. 1, 1914. Such destruction is confined mostly to the actual battle areas. Even in the areas fought over, it is only between the actual battle lines that destruction, even of buildings, is total. Belgium, Poland and Servia have probably been wrecked, and yet it seems probable that even in those countries considerable destructible property is unharmed. Probably farm animals in those countries have almost wholly disappeared. In large number bridges and buildings have been destroyed. Yet the land remains even there, and, as compared with the total capital of the world outside the battle area, the percentage destroyed cannot have been ruinously large. Furthermore, it must be remembered that some material progress has been made outside the battle areas, and probably to some extent even among countries at war. Building has been going on, although more slowly.

Taking account of stock, therefore, there is the same amount of agricultural land; there are the same industrial plants, with some exceptions; the same railroads and the same steamships, with some exceptions. Domestic animals are about the same in number (with the important exception of horses). Houses and other buildings have increased outside the war zone and decreased within it. Stocks of food have been depleted. Stocks of merchandise have been diminished in some cases. Money may be left wholly out of account. It is not capital, but only a symbol. What, then, is occurring, and what does the expenditure of billions upon billions of money mean, if it does not largely mean a destruction of capital?

Prosperity if We Will

The real meaning is that the title to vast wealth is changing hands. The means of subsistence and of fighting, food, clothing and military supplies, are pouring in to the fighting nations from all quarters. In return there will ultimately go outward the titles to wealth formerly held by rich individuals of the fighting nations. It is important to get clearly in mind the distinction between the destruction of wealth, which the bulk of the war expenditures are usually supposed to represent, and the transfer of the title to wealth, which the expenditures in the main really do represent. The latter condition spells great ultimate prosperity for us as a nation, if we will let it. There is just where a sound understanding of elementary economics is vital to American affairs. This title shifting is not going to benefit the common citizen directly. Title to the transferred wealth, except as it may go to farmers, is likely to come into comparatively few hands. The laborer and mechanic will not touch this prosperity very much in the first instance. On the contrary, those classes must suffer and are suffering great hardship, not only from decreased world production, curtailing the supplies available for their consumption, but also in derangement of intricate business machinery, leading to non-employment. In other words, the war seems likely to shift ownership of a good part of the world's capital from rich Europeans to rich Americans. The problem before us is, therefore, to consider how that shifting can be made to yield a widely distributed prosperity in America.

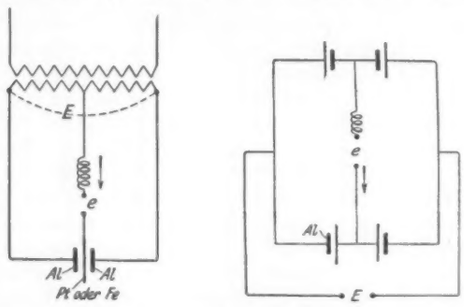
The answer is clear and unmistakable. We must make it to the interest of owners of this newly acquired wealth to employ it in wealth building in this country. The socialist will say at once, "Let the State take this wealth and employ it usefully." Without denying that the millennium may come some day, no prosperity can be brought about this year, or next year, or the year after that, by any such treatment. If we want anything immediately, we must use existing customs. In other words, we must make this country very attractive to the newly acquired capital, if we are going to profit. We must get rid of the notion that capital is not entitled to a profit and must bring ourselves to understand that, at least under the present social system, labor can be employed profitably only when capital is employed profitably.

More closely than any other educated class, engineers come into direct personal contact with the higher grades of wealth-building workers. Their influence is potentially very great. Shall not engineers take an active part in the building of a sane public sentiment, which must necessarily precede any general restoration or prosperity? To achieve the pinnacle of prosperity we as a nation require sound economic ideas and ideals. Shall not engineers lead the way?

DIGEST OF ELECTRICAL LITERATURE

Generators, Motors and Transformers

Aluminum Rectifier. — GÜNTHER SCHULZE. — The author discusses what maximum efficiencies may be expected from electrolytic rectifiers with aqueous solutions. The efficiency is limited by three kinds of losses. The first loss is due to the fact that a certain minimum voltage must be reached before the current will pass in the permissible direction. This minimum voltage is a function of the formation voltage of the aluminum plates. The second loss is caused by the ohmic resistance, and the third by the fact that the impermeability of the rectifier (in the direction opposite to the permissible direction) is not perfect. The last two losses may be made small, but the first loss due to the minimum voltage cannot be reduced at will. The author makes the calculations for two arrangements of the rectifier. The first, shown in Fig. 1, is the transformer system in which *E* is the transformer and *e* is the available direct-current voltage. *Al* represents the aluminum plates, and between them is a platinum (*Pt*) or iron (*Fe*) plate. The second system discussed is the Graetz system, shown in Fig. 2, in which *E* is again the alternating



FIGS. 1 AND 2—TWO ARRANGEMENTS OF ALUMINUM RECTIFIER

voltage and *e* is the available unidirectional voltage. In both cases an induction coil is inserted in the direct-current circuit to make the voltage practically constant. The author first determined the minimum voltage as function of the formation voltage for different electrolytes and calculated the maximum voltage obtainable both for the transformer system and the Graetz system. In both cases the possible efficiencies reach a maximum which is from 80 to 85 per cent, but this maximum is reached for a unidirectional emf of from 60 volts to 80 volts for the transformer system and for from 100 volts to 150 volts for the Graetz system. For small voltages the maximum possible efficiencies are low. For a unidirectional emf of 5 volts the maximum possible efficiencies are about 40 per cent for the transformer system and only 25 per cent for the Graetz system.—*Archiv. f. Elek.*, Vol. 3, No. 1, 1914.

Single-Phase Generators.—J. KOERNER.—A brief description of the 10,000-kva, single-phase alternators built for the Porjus power plant of the Riksgrans Railroad in Sweden. These machines, which are thought to be the largest driven by water turbines, were designed with special consideration of the exacting requirements of operation under difficult climatic conditions. Some test results are given.—*Elek. Zeit.*, May, 13, 1915.

Lamps and Lighting

Photometry of Sources of Light of Different Colors.—MARCELLO PIRANI.—A long illustrated paper presented before the German Illuminating Engineering Society. The comparison of a colored source of light with a white standard lamp may be carried out in such a way that before the standard lamp there is placed a color filter which makes the light of the standard lamp of the same color as that of the lamp to be compared. In order to determine the physiological activity (Wirksamkeit, measured in candle-power) of the standard lamp with additional filter, the physical permeabilities *D* of the filter are determined for each wave-length by means of the special photometer and multiplied with the radiation energy *E* of the standard lamp and the relative sensitiveness *A* of the eye at the same wave-length. The products *D E A* are determined for all wave-lengths and plotted as ordinates with the wave-lengths as abscissas. In this way "the activity curve" is obtained. The "activity area" (Wirksamkeitsfläche) which is inclosed by the activity curve is considered to be a measure of the photometrically active candle-power. This method makes two suppositions—first, that a standard lamp with known radiation curve is used, preferably a carbon-filament lamp the radiation curve of which is that of a black body of the same temperature; second, Ives' figures for the sensibilities of the eye are used. Experimental tests show that the method gives consistent results in practice.—*Zeit. f. Beleucht.*, April, 1915.

Arc Lamps Versus Half-Watt Tungsten Lamps.—The three arc lamp factories of C. Conradty, Planiawerke, and Gebr. Siemens & Company publish two interesting curve sheets of the total cost of different modern types of direct-current and alternating-current arc lamps in comparison with "half-watt' tungsten lamps for 1000 cp-hours as a function of the price of the kilowatt-hour. Two tables are also given which show how the total cost has been determined, stating the figures assumed for amortization, attendance, etc. According to the curve sheets, the total cost of lighting with arc lamps of modern type is in general well below that of lighting with half-watt tungsten lamps.—*Elek. Zeit.*, May 6, 1915.

Incandescent Lamps.—An article by Ray Palmer on the results obtained with nitrogen-filled tungsten lamps in the municipal street-lighting system of Chicago; an article by W. P. Hurley on high-efficiency tungsten-lighting systems; a paper by E. J. Dailey, Jr., on recent incandescent-lamp developments, and a paper by A. R. Dennington on gas-filled tungsten lamps in the making, giving details of the successive steps in the manufacture. —*Elec. Journal*, June, 1915.

Generation, Transmission and Distribution

Coal Supply in Great Britain.—An account of a recent joint meeting of representatives of British gas and electric companies with respect to the present difficulties of coal supply in Great Britain. Sir Corbet Woodall, president of the British Commercial Gas Association, presided. He emphasized that Great Britain faces the prospect of coal famine, but that it is a preventable famine. The mines must be kept working. Sir John Snell, president of the Institution of Electrical Engineers, said that two things are necessary: more coal should be obtained from the coal mines and the transportation facilities from the mines to the gas and electric stations should be improved. First, the following resolution was adopted: "That this meeting congratulates the government on having appointed a committee to deal with the exportation of coal, and hopes this may be effective in limiting exports, but views with the deepest concern the depleted stocks of coal and the difficulty under present conditions of renewing them for present and future requirements, and urges the government to take further and immediate steps (a) to increase the output of coal from the pits, (b) to give greater facili-

ties for the transport of coal by rail, and (c) to have regard in the requisitioning of steam colliers to the requirements of the public utility undertakings which depend for their supplies on sea-borne coal." A second resolution adopted states that "the government be asked to take such steps as may be necessary to reduce the price of coal to reasonable limits." Finally a representative deputation of gas and electric engineers was appointed to present their case to the members of the British Parliament.—London *Electrician*, May 14, 1915.

Electric Plant in Tin Mine.—W. ELSDON-DEW.—A description of the electrical plant of the Swaziland Tin, Ltd. It is a small isolated plant, but is interesting as it has made it possible to rearrange the whole method of work on this property for the recovery of tin. The plant consists of a 250-kva, three-phase generator directly coupled to a Pelton wheel generating energy at 550 volts, fifty cycles per second. The pressure is raised to 3300 volts, at which energy is transmitted in different directions, the greatest distance being approximately 3.5 miles, by overhead wires. Energy is used for raising the gravel out of the riverbed by means of centrifugal gravel pumps to suitable places where the fall from the sluice boxes is sufficient to get rid of the débris. Energy is used for driving high-pressure nozzle pumps for sluicing down gravel and also in workshops, etc.—*Trans. South African Inst. of Elec. Eng.*, March, 1915.

Hydroelectric Plants of France.—H. BRESSON.—A map of France on which the hydroelectrical stations are plotted with circles, the diameter of each circle being proportional to the equipment rating of the plant. The predominance of water-power stations in the Pyrénées and the Alps is well shown.—*La Revue Elec.*, Feb. 5, 1915 (published April 30, 1915).

Power Station.—F. UHLENHAUT, JR.—An illustrated article on the Brunots Island power station of the Duquesne Light Company in Pittsburgh, Pa. The plant is laid out to contain ultimately ten 15,300-kw turbo-generator units. Four of these are now installed.—*Elec. Journal*, June, 1915.

Installations, Systems and Appliances

Low Rate in British Central Station.—An editorial note pointing out that the wisdom of supplying electrical energy for motor service at such low prices as 1 cent per kw-hr. has sometimes been questioned. But this policy of low rates has produced excellent results in various cases. Coventry is a case in point. Six years ago the output amounted to only about 4,250,000 kw-hr., but during the past year the kilowatt-hours sold amounted to 20,500,000, and this was 4,250,000 more than in the preceding year. The lighting part of the load is now only 6.9 per cent of the total, so that the output is almost wholly for motor service, and yet the net profit was nearly $115,000. This happy result has been obtained by careful management, and by following the sound policy of making concessions to consumers whenever the profits admitted of this being done. Thus is it that electrical energy is now sold at such prices that it is not worth while for any manufacturer to install a private plant, and consequently electrical energy is being supplied to most of the large engineering works at Coventry.—London *Electrician*, May 14, 1915.

French Central Station.—Until recently the city of Oran had two electric stations. The first belongs to the gas company and supplies an overhead network for lighting, the three-wire direct-current system being used at 2×220 volts. The second belongs to the tramway company and furnishes direct current at 500 volts for seven tramway lines having a total length of 17 km (10 miles). Since these stations were not sufficient for a city of 112,000 inhabitants, another station has recently been erected containing two turbo-driven three-phase alternators each of 2000-kva rating, the voltage being 6200 to 6600 and the frequency fifty cycles. Two other sets of 4000 kva each are to be installed later—*La Revue Elec.*, Feb. 5, 1915 (published April 30, 1915).

Extensions of British Central Station.—An illustrated article on recent extensions of the South Shields Electricity Works. The recent extensions include a new boiler house and the installation of two turbine sets aggregating 3500 kw. The first turbine set comprises a turbine coupled directly to two generators, that is, a 1000-kw, 500-volt to 550-volt direct-current turbo-generator with a radial-type commutator and an 1100-kw, single-phase, 2100-volt, fifty-cycle alternator coupled in tandem and running at 1500 r.p.m. This set was installed in 1912, and the second set in 1914. The latter comprises a turbine directly coupled to two 1500-kw, 2100-volt, three-phase, fifty-cycle turbo-alternators, coupled in tandem and running at 3000 r.p.m.—London *Electrician*, May 14, 1915.

Electrophysics and Magnetism

Electric Conduction in Selenium.—F. C. BROWN.—An article in which the author attempts to build up a simple electron theory to correlate the most fundamental photo-electro-mechanical properties in metallic selenium. The author achieves a simple consistency of results. It is first shown that the electrons do recombine very rapidly with what is supposed to be the atomic structures, and the recombination takes place according to the same law governing the recombination of ions in gases. But we cannot conclude from that that the current is transported in the same way in selenium as an ionization current in gases. The basis of the theory receives further support in that a common explanation accounts both for the variation from Ohm's law and for the large changes of conductivity accompanying pressure changes. In each case the coefficient of recombination of the electrons is found to vary inversely as the variable conductivity imposed by the pressure change or the difference of potential. And, likewise, there is common evidence that the rate of production of conducting electrons by a fixed illumination is directly proportional to the variable conductivity imposed by pressure or voltage.—*Phys. Review*, May, 1915.

Heating and Elasticity of Steel Wire.—H. L. DODGE.—An account of an experimental investigation of the change in the elasticity of a mild-steel wire with current and external heating. The sample showed very erratic changes in elasticity when first heated. By continued heating and stretching it was brought to a cyclic condition, or steady elastic state, in which Young's modulus becomes a function of temperature. This was secured first for a temperature range of 20 deg. C. to 300 deg. C., and later for a range extending to 475 deg. C. Continued heating and stretching gradually increased the modulus, the effect being probably caused largely by the stretching. Except for the small gradual increase above mentioned, the modulus of the wire was independent of history, the thermal route by which any temperature was reached having no apparent influence upon the value of the modulus. Heating by an electric current has no effect other than that caused by the accompanying temperature. This is in direct contradiction to the work of Walker. The very small changes in the modulus caused by magnetization reported by other investigators would not have been detected by the present author's apparatus. The Young's modulus of the wire decreased with increase of temperature at an increasing rate. The modulus decreased slowly and almost uniformly up to a temperature of about 300 deg. C. Then the rate of decrease became more and more rapid, the plotted curve becoming very steep at 475 deg. C.—*Phys. Review*, May, 1915.

Effect of Gases on Electron Emission from Glowing Solids.—A brief note on the results of an investigation made by F. Horton on the ionization produced by a glowing Nernst filament when used as a discharge tube in the presence of various gases of different chemical affinities for the material of the filament. The results were communicated in a paper before the Royal Society. The actual electron emission from the filament is independent of the nature of the surrounding gas—at least for the gases air, nitrogen, oxygen and hydrogen—for at low pressures the thermionic currents measured under similar conditions in these gases were practically the same. At higher pressures the thermionic currents differ considerably owing to the effect of ionization by collisions being different in the different gases. The increase in the current due to ionization by collisions in hydrogen is much greater than it is in air, oxygen or nitrogen. The experiments were repeated with a Nernst filament covered with lime, and it was similarly found that the electron emission from lime under these conditions was not increased by hydrogen, although earlier experiments have shown that lime heated on platinum gives a much larger electron emission in hydrogen than it does in air. This appears to be caused by the hydrogen increasing the emission from the platinum, an effect which has been shown by H. A. Wilson to be due to the absorption by the metal. Lime and the oxides of a Nernst filament do not absorb hydrogen, and the electron emission from these substances is therefore unaltered by the presence of this gas. That the electron emission from an oxide cathode is the same in oxygen and in hydrogen, gases which have very different chemical affinities for the material of the cathode, is evidence against the theory, which has lately been put forward, that the electron emission from a glowing solid is due to chemical action between the solid and the surrounding gas.—London *Electrician*, April 30, 1915.

Fluorescence.—FRANCIS G. WICK.—An account of an experimental investigation of the fluorescence of the uranyl salts under X-ray excitation. The fluorescence excited in the uranyl salts by X-rays differs from that excited by light in intensity only. The greater absorption of these salts for light than for X-rays accounts for the difference in intensity of the fluorescence under the two sources. The phosphorescence following excitation by light is less intense and of shorter duration than that excited by X-rays. The difference in penetration of the two kinds of radiation seems to explain this, the more penetrating X-rays producing a phosphorescence which is more intense and of longer duration than that following the less penetrating light rays.—*Phys. Review*, May, 1915.

Units, Measurements and Instruments

Alternating-Current Potentiometer. — CHARLES V. DRYSDALE.—An illustrated article on the use of the alternating-current potentiometer as a standard instrument. Fig. 3 shows the diagram of connections of the instrument, which consists of an ordinary potentiometer fed with alternating current from the secondary of a phase-shifting transformer, through a dynamometer ammeter *A*. The phase-shifting transformer is in principle like a two-phase induction motor with wound rotor, and a uniformly rotating field is produced from the single-phase supply by the aid of a condenser *K* and resistance *R*, in series with one of the stator windings. In consequence, a current of fixed value, indicated by the dynamometer *A*, passes through the potentiometer coils, and the magnitude and phase of the potential difference *v* between the sliding contacts of the potentiometer are varied by sliding the contacts and by turning the secondary of the phase-shifting transformer. It is, therefore, possible to obtain a potential difference from the potentiometer which can be brought into exact coincidence as regards magnitude and phase with any potential difference to be measured which is derived from the same source of supply, and this coincidence is determined by a vibration galvanometer *G*. The author discusses the accuracy of measurement and shows that

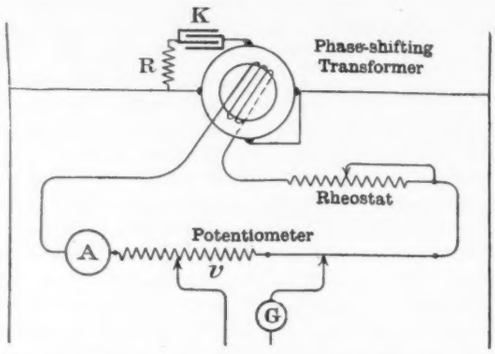


FIG. 3—PRINCIPLE OF ALTERNATING-CURRENT POTENTIOMETER

the potentiometer reads correctly when the wave-forms of the potentiometer and measured potential difference are both sinusoidal, or both similar as regards the magnitude of the successive harmonics, without reference to their phase. By using an alternator or rotary converter with well-designed poles or windings there is no difficulty in getting a wave-form with less than a 2 per cent harmonic, and in this case the potentiometer measurement may be regarded as free from error, provided that the machine is not so loaded as to distort the wave seriously. The phase-shifting transformer, with its phase-splitting device, produces no sensible distortion of wave-form. The author then deals with the errors of dynamometer instruments and shows how the "constant" of dynamometer varies with frequency. He finally gives the results of measurements made with the potentiometer in actual practice in comparison with other standard instruments for measurements of potential difference, current and power.—London *Electrician*, May 7, 1915.

Testing Electrical Porcelain.—A. CHERNYSHOFF AND C. A. BUTMAN.—Until quite recently electrical porcelain has been tested at sixty or twenty-five cycles with voltages below the flash-over point of the insulator. However, practice has shown that insulators which had passed such a test quite often failed in service; in particular, a heavy thunderstorm would break many insulators. Hence, to duplicate as nearly as possible the effects of a lightning stroke, Imlay and Thomas were led to try a high-frequency impulse test. Their work was followed by that of E. E. F. Creighton, who called attention to the availability of the Tesla coil for high-frequency test of insulators. The present paper deals with an investigation of the relative merits of the various methods of testing porcelain and the development of a new method to resemble more closely the effects of a lightning stroke. These tests were made on a limited number of insulators, and while the results that are of a laboratory nature are entitled to considerable confidence, it would require the testing of a much greater number of insulators to determine just what kind or method of test would be most suitable for commercial purposes. The tests indicate that the following conclusions are warranted: By means of high frequency it is possible to raise the voltage on an insulator in air above the sixty-cycle flash-over voltage. Inasmuch as the same break-down voltage was obtained with the Tesla coil, the Imlay and Thomas test and sixty cycles under oil, it

is concluded that the frequency of itself has little effect on the break-down strength. The effect of high frequency is to raise the voltage which can be applied to the insulator in air. Hence the break-down is due to the voltage primarily and not to the frequency. The break-down of porcelain is due to the electrostatic stress and not to heating. The character of the break-down at high frequency and sixty cycles was different. It would seem of little use to apply a high-frequency test of any kind to insulators below the sixty-cycle flash-over value. —*Elec. Journal*, June, 1915.

Telegraphy, Telephony and Signals

Telegraph Disturbances Caused by Single-Phase Railroads.—O. BRAUNS.—The first part of an illustrated paper giving the results of researches carried out by the German telegraph department. In the present instalments the author gives the general theory. The trolley wire, the primary winding of the transformer on the locomotive, the track which is used as return circuit, and the source of energy at the power plant or in the substation form a loop which continually changes with the movement of the train. This causes changes of both the electric field and the magnetic field and thereby produces effects on telegraph lines in the neighborhood. Disturbances caused by changes of the electric field are called "influence" by the author, while disturbances caused by changes of the magnetic field are called "induction." Moreover, if the earth is used as a return circuit there may be a voltage drop at different points of grounding, and this may cause disturbances. The author first discusses the theory of these three types of disturbances, and then begins to give the results of experiments on suitable remedies for overcoming them. —*Elek. Zeit.*, May 6 and May 13, 1915.

High-Speed Telegraphy.—OTTO ARENDT.—It is no longer correct to distinguish the two types of high-speed telegraph systems as machine telegraph systems and multiplex telegraph systems. The former system has not been restricted to the substitution of machine work for manual work, and the latter system has not been restricted to endeavors to utilize the line to the utmost by suitable connections of different sets of apparatus to the line. The advantages of either system must have been made use of by the other as far as possible. The distinguishing feature now is that in the one type of system one single transmitter supplies in succession the telegrams to their receivers (simplex high-speed telegraphy), while in the second type of system several transmitters in succession and in regular repetition are connected through the line to their corresponding receivers for short periods in which always one signal is transmitted, so that several telegrams are transmitted at the same time (multiplex telegraphy). The author compares both systems as to their advantages and disadvantages in practice. He finds that the multiplex-telegraph system may transmit more quickly a single telegram under certain conditions, while the simplex-telegraph system permits sending more dispatches in the same time.—*Elek. Zeit.*, April 22 and 29, 1915.

Miscellaneous

Water Sterilizer.—An illustrated description of a portable electrically heated water sterilizer. There are six electrically heated sterilizing chambers mounted on a motor lorry, and supplied with energy from a generator driven by the main driving shaft of the lorry. Two electric pumps are used to pump the raw water to a tank on the roof and to deliver the sterilized water into portable tanks or to water carts as required. The sterilizer chambers provide for the heating of the water up to 80 deg. C. and subsequent cooling.—London *Electrician*, May 14, 1915.

Book Reviews

ENGINEERING OFFICE SYSTEMS AND METHODS. By John P. Davies. New York: McGraw-Hill Book Company, Inc. 544 pages, 244 illus. Price, $5.

A wealth of material is here presented dealing with the details of engineering office routine which the engineer is apt to overlook or with which he has not considered it necessary to acquaint himself. The opening chapters give at length the information to be supplied for obtaining designs and estimates, outlines for designs and details for checking drawings, a system of specification writing, some examples and a number of outlines, and reminders for obtaining quotations on standard material. Two chapters are devoted to purchasing-office methods and forms and to cost-keeping and estimating. The details incident to domestic and export shipping are made very vivid by the aid of illustrations and shipping forms. The author criticises in a masterly way the many systems of indexing and filing used in different engineering offices and gives a great deal of valuable advice to the beginner. The chapter on drawing-office systems and methods could well be used as a systematic guide in any drawing office. Other chapters are devoted to sampling, inspecting and testing of materials, progress charts and scheduling systems, and abbreviations, fees and contracts. As a system of useful hints and reminders to practising engineers the book should be very valuable.

POCKET EDITION OF DIAGRAMS AND COMPLETE INFORMATION FOR TELEGRAPH ENGINEERS AND STUDENTS. By Willis H. Jones. New York: Telegraph and Telephone Age. 464 pages, 227 illus. Price, $2.

This comprehensive volume is written as a reference and instruction book for practising telegraph men. Beginning with the most elementary theory of applied electricity, the author proceeds to descriptions of the apparatus and adjustments commonly used in the large telegraph systems of this country. Some of the sixty-four chapters cover the numerous variations in detail of duplex and quadruplex methods, describe a large number of repeaters and many forms of station and switchboard equipment, and give well-tried line tests used by telegraph and telephone men throughout the United States. Telephony, simultaneous telephony and telegraphy, wireless telegraphy, call-box, ticker and selector systems, and automatic and simultaneous telegraphy are all treated. The book concludes with an appendix of wire tables, diagrams and an index. Abounding with practical hints as it does, it should prove of considerable value to the worker in telegraphy. Not all of the abstract theory given is entirely sound, but there is very little of this, and the application of simple electrical principles to telegraph circuits seems in every case both pertinent and correct.

Books Received

Resuscitation from Electric Shock, Traumatic Shock, Drowning, Asphyxiation from Any Cause, by Means of Artificial Respiration by the Prone Pressure Method. By Charles A. Lauffer, A.M., M.D. New York: John Wiley & Sons, Inc. Second edition, 90 pages, illus. Price, 50 cents.

Dielectric Phenomena in High-Voltage Engineering. By F. W. Peek, Jr. New York: McGraw-Hill Book Company, Inc. 266 pages, 190 illus. Price, $3.

Dynamometers. By Rev. Frederick John Jervis-Smith, M.A., F.R.S. Edited and amplified by Charles Vernon Boys, F.R.S. New York: D. Van Nostrand Company. 268 pages, 119 illus. Price, $3.50.

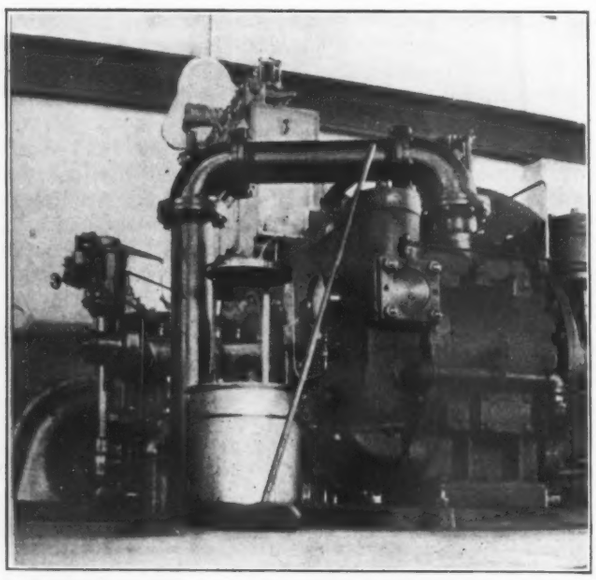
POWER AND OPERATING SECTION

Lamps Show When Men Enter High-Tension Compartments

At the Livingston power station of the Richmond Light & Railroad Company, Staten Island, New York, a bank of five red signal lamps is installed on the switchboard gallery, the lamps being so connected with the doors of the wire gratings inclosing the oil switches, busbars and other current-carrying parts and apparatus installed under the main switchboard that the opening of any door lights the corresponding lamp, thus giving the switchboard operator notice that someone is entering one of the inclosures. A signal lamp is also lighted above the corresponding door itself, thus indicating the open compartment to anyone within sight of the lamp. Regular door-type switches are employed to make and break the circuits. Yale locks, with individual keys properly tagged, lock each compartment. These keys are obtainable only from the switchboard operator on duty. A master key is, however, kept in a glass case, which can be broken easily when necessary, and provides for any emergency that may arise.

Taking Care of Oil Cans and Oily Waste

Small hand oil cans, oily rags and waste are articles that are frequently found out of place and lying around in a power house. Besides giving a station a slovenly appearance, such articles when thrown down where they are used create an added fire hazard. At Dubuque, Ia., in the station of the Union Electric Company, special sheet-iron receivers for rags and waste are used to eliminate this trouble. The can part of these receivers rests upon legs about 4 in. above the floor and is provided with a hinged lid. Above this can, mounted on three strap-iron supports at a convenient height, is a shallow pan that acts as a shelf for hand oil cans.

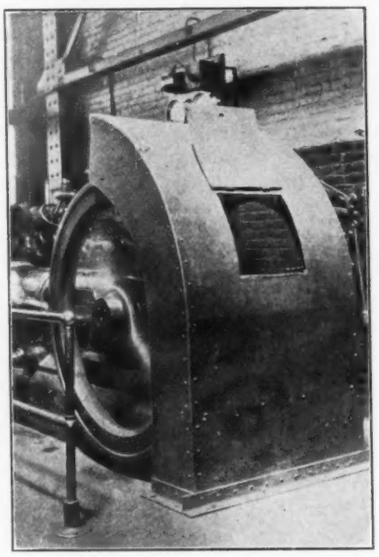


A PLACE FOR SMALL OIL CANS AND OILY RAGS

Although the large can portion of these receivers is not divided, it has been suggested that a partition might be installed so that one side of the can could be used for sweepings and the other side for such rags and waste as are clean enough to be used again.

Safeguarding a Dry-Vacuum Pump

One of the results of a safety campaign being conducted by the Lowell (Mass.) Electric Light Corporation is the inclosure of the double flywheels and crank of a large dry-vacuum pump at the Perry Street station. Protection is afforded by a riveted sheet-iron guard 15 in. wide and 46 in. long, mounted on an angle-iron frame bolted to the floor. A central opening about 18 in. square, with a hinged cover, provides access to the crank for inspection during running. The sides are guarded by pipe rails.



A SUBSTANTIAL SAFETY GUARD

Selling Exhaust Steam Versus Operation Condensing

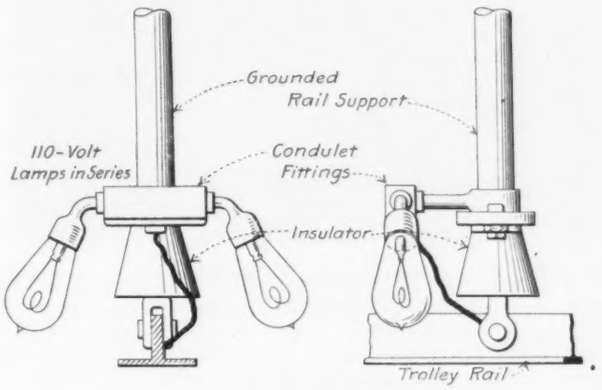
In regions where steam-heating loads are obtainable it may be possible, in the commercial sense, to obtain as high plant economy by selling exhaust steam from the prime-mover units as by condensing the exhaust and operating the units under a vacuum. This is shown by data for a Western town of 8000 people.

The total investment required for steam heating, including meters, services, etc., was $28,643. With interest at 6 per cent and depreciation at an equal rate the fixed charges were $3,437.16. Dividends and operating expense made an additional item of $1,425, or a total of $4,862.16. Deducting this amount from the steam-heating revenue, which amounted to $8,379.89, left $3,517.73, the net heating revenue.

If this amount in turn is deducted from the total coal bill of $7,657.59, the net coal bill required for generating electricity is found to be $4,139.86. Dividing this amount by $1.72, the unit cost of the coal per ton, shows that an equivalent of 2407 tons of coal was required to generate all of the electrical output of the plant. As 661,800 kw-hr. of energy was generated, the coal rate would therefore be 7.27 lb. per kw-hr., a result which is comparable with figures obtainable from any small-sized condensing plant, especially when interest and depreciation on the condensing equipment are included in the fixed and operating expenses. The load-factor of the plant ranges from 26 to 35 per cent, and the calorific value of the coal is about 11,500 lb. Fahr. units.

Danger Signals on Ash-Locomotive Trolley

Objections have sometimes been raised to employing trolley locomotives inside buildings where persons may come in contact with the trolley wire or a rail. At the 201st Street station of the United Electric Light & Power Company, New York City, where direct-current trolley locomotives are employed for conveying ashes, practically all danger is eliminated by maintaining the trolley rail at only 220 volts above the ground pressure and equipping the trolley rail with danger signals which indicate when the conductor is energized. The overhead conductors, which consist of T-section bars, are supported several feet above the average man's head by vertical rods and insulators attached to the ceiling. The insulators are placed between the lower ends of the vertical supports and the trolley rail, being attached to the latter by tongue-and-groove joints and to the rods by a clamp. The vertical rods are all grounded so that two 110-volt incandescent lamps can be connected in series between the lower ends of alternate rods and the trolley rail to indicate when the latter is energized. Red lamps are used to signify danger.



RED LAMPS CONNECTED TO SHOW WHEN CONDUCTOR IS ENERGIZED

At present two locomotives are employed capable of hauling six 45-cu. ft. cars. Each locomotive is equipped with two 5-hp motors which can be operated in series or parallel to obtain the desired speed. These cars are employed to convey ashes from the hoppers under the boiler furnaces to an inclined skip hoist which empties the ashes into a concrete bunker on the river front. In disposing of the ashes barges are placed under the bunkers and the contents discharged by gravity through chutes into the vessels' hatchways.

Fuel Cost for Small Oil Engine

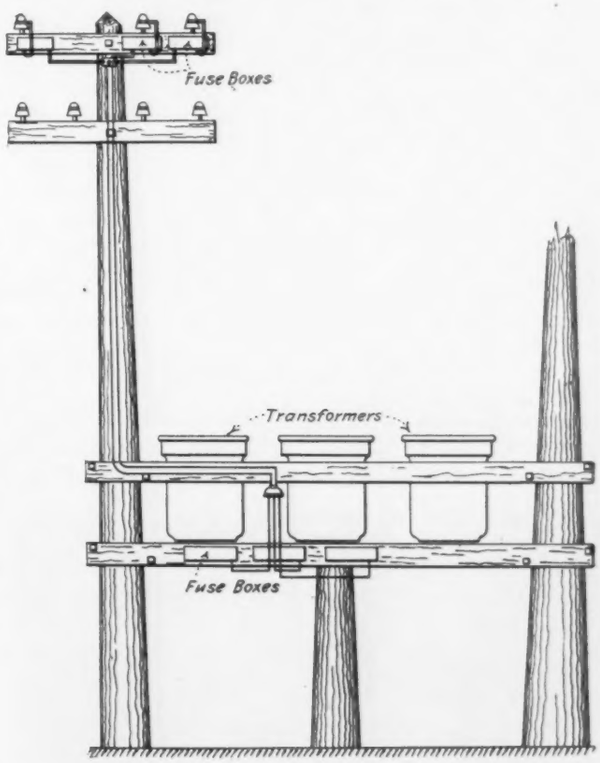
At the plant of the Goodland (Kan.) Light & Power Company a 165-hp Chuse high-speed steam engine and a 60-hp Muncie oil engine are being operated side by side. It is the operating policy of the company to keep the oil engine loaded to the limit of its rating whenever possible and to use the steam engine about four hours every day to help carry the lighting peak.

In commenting on the operation of this equipment, Mr. William H. Frazier, manager of the Goodland company, says: "We use the oil engine twenty-four hours a day, and ten hours would cover the time it has been shut down in six months' time. During this period we have made a saving of $225 a month in our fuel bill over the cost of running entirely with steam as we did before. Our cost for attendance has remained the same. Our unit cost for fuel for the oil engine is 0.6 cent per kw-hr., and on account of the higher cost of steam operation our average fuel cost is 0.9 cent per kw-hr. We experience no trouble in operating the steam engine and the oil engine in parallel."

Two Sets of Fuses on Transformer Bank

It has become the practice of the Springfield (Mo.) Gas & Electric Company, when building customers' transformer installations, to use two sets of fuses between the 2300-volt mains and the transformers themselves. One set of fuses, rated at double the normal transformer amperage, is placed at the pole top, while another set, one-half as heavy as the first, is placed on the transformer rack. This method of construction has been adopted, it is explained, to insure greater reliability of service to all of the company's patrons. The upper set of fuses is really used as protection against trouble which might occur in the iron-pipe conduit conducting the 2300-volt leads from the cross-arm to the transformer bank.

If a short-circuit were to occur in this conduit with the present arrangement, the fuses at the cross-arm would be blown, protecting the 2300-volt mains from trouble. Troubles from short-circuits or overloading within the customer's plant are guarded against by the fuses of normal transformer rating placed near the units.



DOUBLE FUSE PROTECTION FOR TRANSFORMERS

The Enlarged Power and Operating Section

Owing to the large number of pages filled by the N. E. L. A. convention report in this issue of the ELECTRICAL WORLD, it has seemed advisable, as announced last week, to publish the enlarged Power and Operating Section in our next issue, bearing date of June 19, instead of this, the second issue of the month, for which it is regularly scheduled.

A Welding Job That Saved a Thirteen-Day Delay in Plant Construction

The casting shown in Fig. 1 is a portion of a connection designed for use in a Middle Western power house between the exhaust outlet of a steam turbine and the inlet of a condenser. Conditions arose in the construction of this power house which made this casting too long, and at first seemed to call for an entirely new casting at a cost of $300 and a delay of at least twenty-five days. A reconsideration of the design of the casting showed, however, that an 18-in. section might be removed, the flange set back and welded into position.

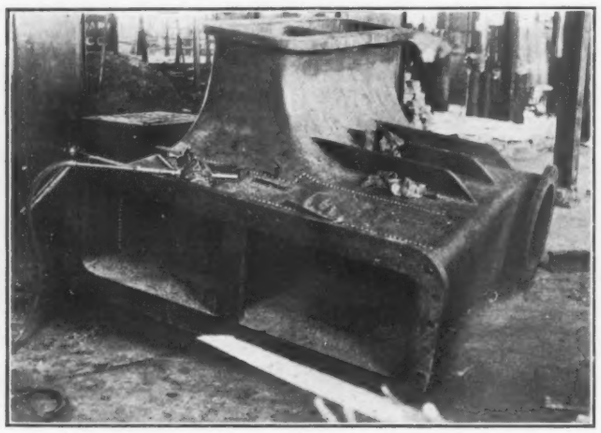


FIG. 1—SECTION OF STEAM TURBINE EXHAUST OUTLET PARTIALLY DRILLED FOR REMOVAL

The casting is shown in Fig. 1 in its original size with the 18-in. section partially drilled out. The drilling was done electrically as it was impossible to cut the cast iron with an oxy-acetylene flame. After the 18-in. section had been removed and the flange replaced a brick preheating furnace was built up around the parts to be welded. This furnace is shown partially torn down in Fig. 3.

The welding operators are shown at work in Fig. 2, using oxy-acetylene flames. Little can be seen of the casting on account of the asbestos sheets used to retain the heat given off by the charcoal preheating fire, which burned continuously during the thirty-six hours required to complete the work. The four welders worked continuously during this thirty-six-hour period. The completed job is shown in Fig. 3, the photograph being taken before the weld had been filed or smoothed. The section removed is also shown.

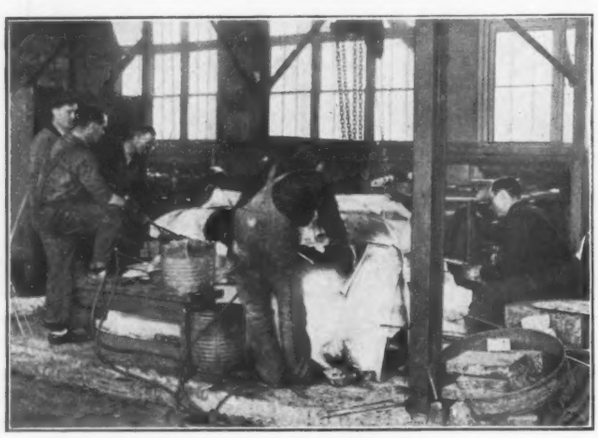


FIG 2—WELDING WITH OXY-ACETYLENE FLAMES

By reducing the size of this casting instead of ordering a new one the delay entailed was reduced about one-half. Three days were required to cut the casting and get it ready for welding; one and one-half days were required to weld it, and about seven days were required for transportation to and from Chicago, making a total of twelve days from the time the casting left the power house until it was returned with dimensions corrected.

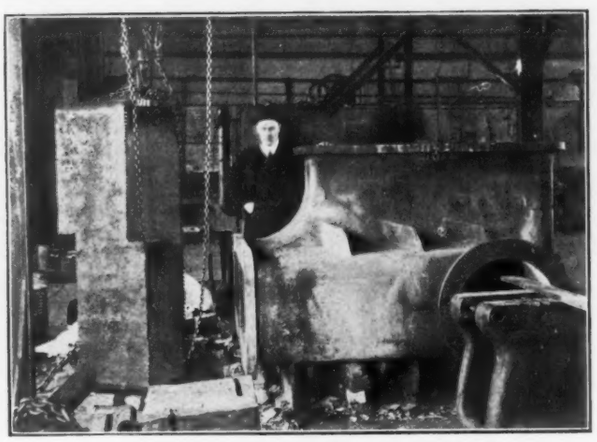
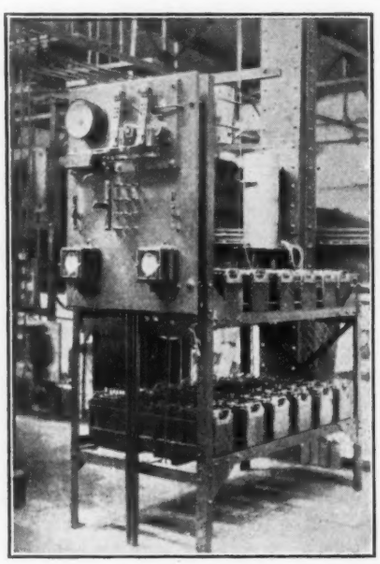


FIG. 3—THE SECTION REMOVED AND CASTING IN REDUCED SIZE AFTER BEING WELDED

Convenient Mounting of Operating Battery

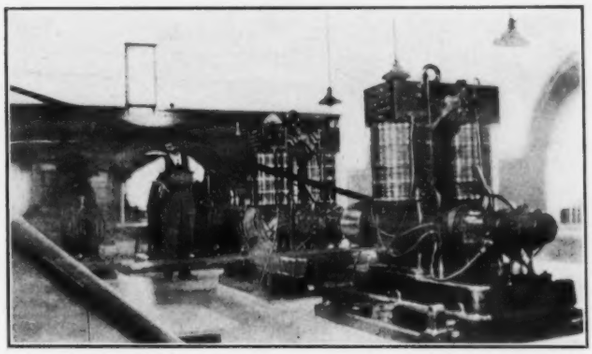
At the State Street station of the United Electric Light Company, Springfield, Mass., a battery of 108 Edison cells is employed for the operation of oil-switch solenoids and engine-room signals. Instead of being installed in a separate room the cells were mounted in two groups on a frame of 2-in. by 2-in. by ⅜-in. steel angles, open on each side and occupying a space of only 4 ft. by 5 ft. by 2 ft. 8 in. At the front end a switchboard panel is provided, on which are mounted two Sangamo ampere-hour meters. The battery is discharged with all cells in series, but is divided into two equal sections by a double-throw switch in charging. The empere-hour meters enable the groups of cells to be charged uniformly.



A CONVENIENT BATTERY MOUNTING

Old-Timers Still in Service

Still giving good service in the hydroelectric station at Sault Ste. Marie, Ont., are two 45-kw, 500-volt Edison bipolar generators which have been in operation twenty-one years. They are belted to a water turbine and can be connected in parallel to furnish energy for operating the ship-canal lock gates and the Canadian

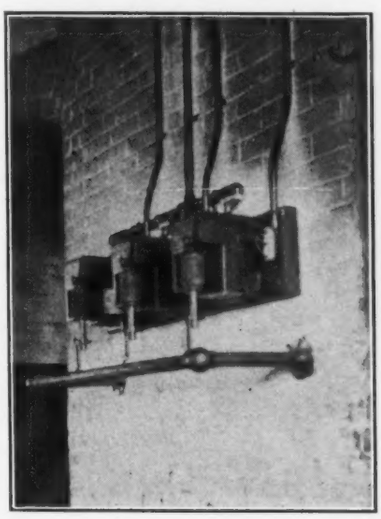


TWENTY-ONE YEARS OF SERVICE AT THE "SOO"

Pacific Railway Company's swing bridge. A 5-kw, 115-volt generator of the same type furnishes energy for lighting the buildings. All of the machines are in good condition.

Protection of Oil Switches

In a Massachusetts factory where the oil switches controlling the motors in various departments are grouped together, as shown in the accompanying illustration, a simple but effective pipe-rail guard is used to prevent accidental contact with the switch group by passing workmen. The switches are mounted on an interior brick wall on a wooden panel about 6 ft. above the floor. Twelve inches below the switches a 1.25-in. pipe rail is carried outward from the wall about a foot, so that the employees' shoulders will not brush against the solenoid plungers which are features of these

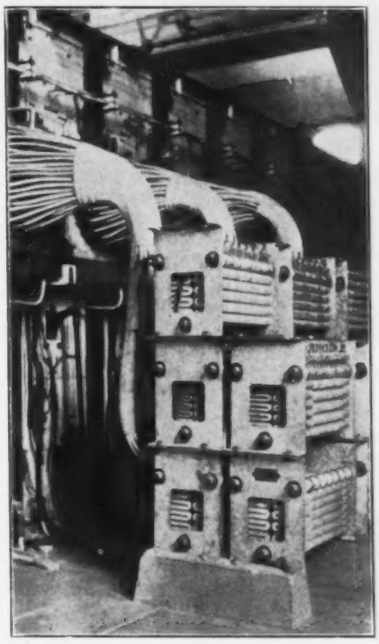


GUARD RAIL PROTECTING OIL SWITCHES AND RELAYS

switches on account of the provision for automatic overload opening. The illustration also shows the convenience and protection afforded by wiring in conduit. The supply circuit for all three switches and their motors is brought down to the gang pipe in the middle and terminates in a conduit bus from which short leads are carried to each switch through porcelain-bushings.

A Substantial Field Rheostat Mounting

In the Saccarappa generating station of the Presumpscott Electric Company, Westbrook, Maine, special attention has been given to mechanical details when installing the field rheostats required by the turbine-driven units. As shown in the accompanying illustration, the rheostats are mounted on concrete blocks at the rear of the switchboard, the taps from the contact buttons on the board being bunched together by 0.125-in. rope and carried downward behind the exciter buses with a total clearance of about 2 ft. The rheostats are bolted together at end shields, five units being required for each of the three 450-kw generators in the station. The concrete mounting blocks are 4.5 in. wide at the top, 5.5 in. wide at the bottom, and spaced about 2 ft. apart on centers. To hold two rheostat units a pier 21.5 in. long



RHEOSTATS MOUNTED ON CONCRETE BLOCKS AND BOLTED TOGETHER AT ENDS

at the top and 23 in. long at the floor level is required, the height of each pier being 6 in. Four piers are needed for the fifteen rheostats, and the entire installation, exclusive of the leads, occupies a space only 6 ft. long, 2 ft. wide and 4 ft. high. At the right of the bank is a further clearance of 6 ft. between the outer units and the wall, so that the unusually liberal space assigned the switchboard adds convenience to the arrangement.

Improving the Emergency Man's Load-Factor

The life of an emergency man is a series of "peaks"—when he is wanted he is wanted badly and everything else must give way. There are, however, many and wide "valleys" in his activities. Emergency calls are, of their very nature, occasional, and therefore do not take up all the time of a special emergency force. In order to maintain skilled emergency men, the Southern California Edison Company has found it necessary to provide continuous employment for its men; hence the emergency department has solicited regular work in the shop to fill in the valleys. Among other jobs given the men have been the rewinding of fan motors and the building of disconnecting switches and test panels. On these two items alone the company has saved in the past five years approximately $20,000.

COMMERCIAL SECTION

IRRIGATION IN THE WENATCHEE VALLEY

Horticulture in Famous "Apple Country" Affords a Fertile Field for Sale of Electric Pumping Energy

By Arthur Gunn*

The Wenatchee Valley—"the home of the big red apple"—is situated in the exact geographical center of the State of Washington. This valley and the contiguous territory are covered by the lines of the Wenatchee Valley Gas & Electric Company. Agriculture and horticulture are here entirely dependent upon artificial irrigation, for the annual precipitation, principally in the form of the winter snowfall, is very light, averaging less than 12 in. per annum from records taken over a period of years.

The first development of irrigation was naturally by gravity canals from the Wenatchee River and numerous other streams. Lands inaccessible by this means were later developed by pumping plants, at first operated by steam and gasoline engines. Since the extension of the company's electric-distribution system provided a cheaper and more reliable supply of power, these earlier plants have gradually been converted to electric power, until now almost all irrigation work done within reach of the company's lines depends upon the hydroelectric supply. At the same time irrigation has been extended to higher lifts, which would have been commercially impracticable with the higher-cost powers.

One peculiar feature of an electric motor-service business where, as here, irrigation pumping forms a considerable portion of the total is that in a sense the company's commercial department is "stood on its head"—for by the nature of things the annual peak comes in the summer, and the commercial department is at its wits' end to find something with which to fill the winter valley. Electric heating has naturally been thought of in this connection, but, owing to the low calorific value of electric current and the high cost of the equipment necessary, it proved practicable in only a limited way.

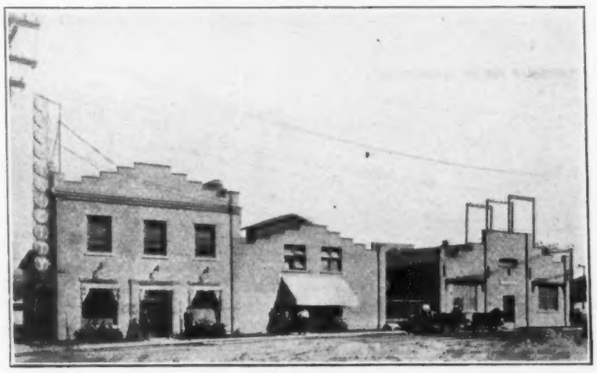


FIG. 2—WENATCHEE OFFICE AND SUBSTATION

From the operating standpoint the summer peak is desirable, for streams fed from mountain snows are at their lowest stage in January and February, while they carry a large volume in the warm months. This enables their development without steam auxiliary to ratings approaching their full theoretical value. Line trouble and other operating difficulties are also at their minimum in the summer months.

*President Wenatchee Valley Gas & Electric Company.

FIG. 1—THE WENATCHEE VALLEY—THE "HOME OF THE BIG RED APPLE"—IS CROSS-SECTIONED BY THE TINY STREAMS FROM ELECTRIC PUMPS

At present there are dependent upon the company's lines seventy-seven irrigation pumping plants, ranging in size from 1 hp to 250 hp, with a total connected load of 1092 hp. The heads pumped against vary all the way from 12 ft. to 500 ft., the majority ranging between 100 ft. and 200 ft. The total acreage served is something

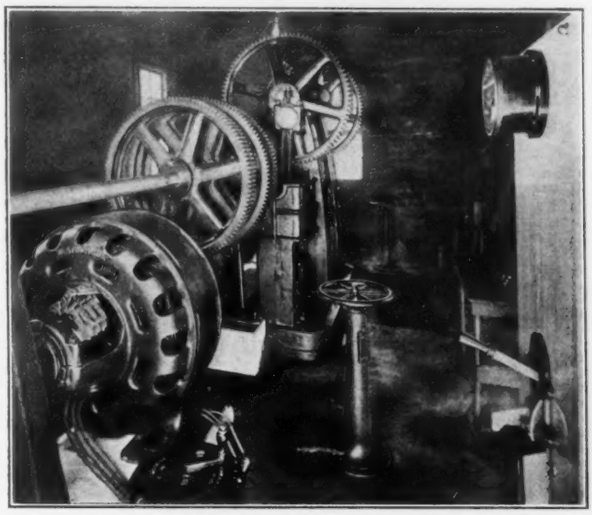


FIG. 3—DEEP-WELL TRIPLEX PUMP, SHOWING CHANGEABLE GEARS FOR PUMPING AGAINST VARIOUS HEADS

over 5000 acres, and the revenue derived from this class of business in 1914 formed 22 per cent of the gross operating revenue of the company.

Rates for Electric Irrigation

The irrigation season is usually five months long, beginning in April and ending in October. Under the five-year flat-rate form of contract the charge is $7.20 per month per rated horse-power of motors connected, or $36 per horse-power per season, with discounts for large-quantity use. If energy is taken only during daylight hours, the monthly charge is reduced to $5 per

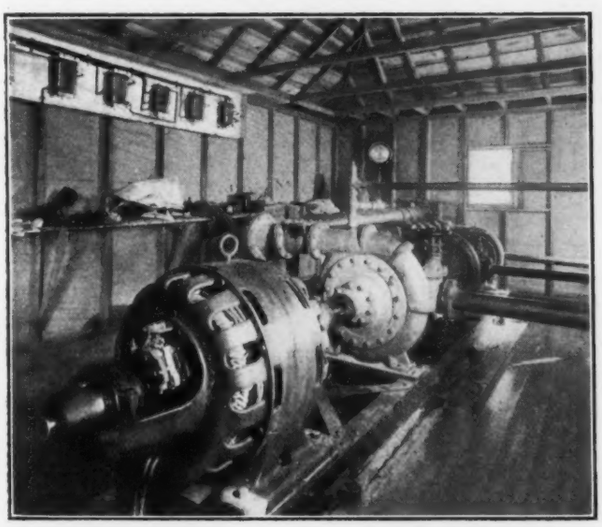


FIG. 4—DIRECT-CONNECTED CENTRIFUGAL PUMPS ARRANGED FOR MULTIPLE AND COMPOUND CONNECTION

horse-power. A maximum-demand rate of $7.20 per month per horse-power of actual demand is also offered under terms of a five-year minimum contract. For irrigation service under a two-year contract agreement, a flat-rate charge with annual fixed service charge is available, the fixed charge amounting to $12 per year per horse-power of customer's demand, with a monthly charge of $5 per horse-power. As has been indicated, the annual peak comes in the summer, and until a balancing winter load can be obtained the irrigation business must be made to bear its full share of the annual fixed charges—which it does.

The sources of supply from which water is pumped are wells, streams and irrigation ditches. The supply for a large number is taken from the Columbia River. As the difference in elevation of the surface of this stream varies something like 40 ft. between low and high water, exceeding suction distance, the pumps are usually installed in concrete wells, being above the water surface at low water and below it at high water. In the latter situation provision is usually made for bailing out any seepage, although in some cases the pumps are operated submerged.

Many of the plants deliver water successively at different elevations. In order to have the power demand

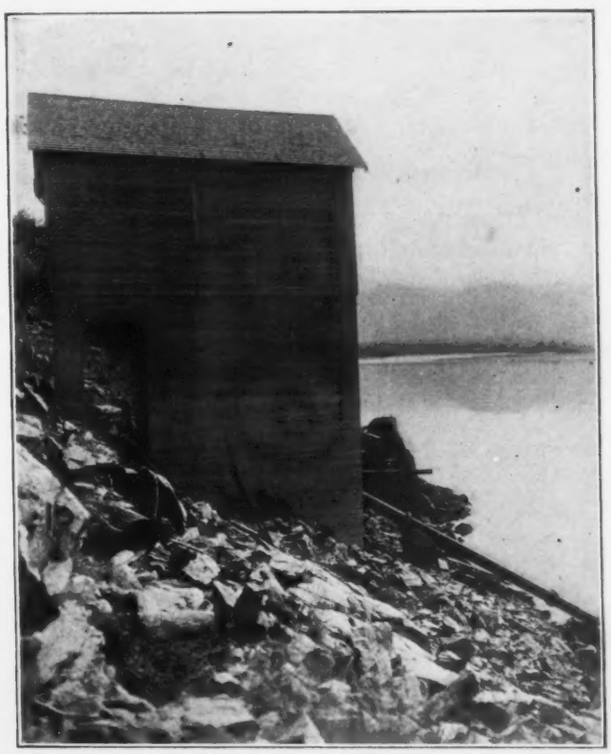


FIG. 5—IRRIGATION PUMPING PLANT ON THE COLUMBIA RIVER NEAR WENATCHEE

constant, provision is usually made to change the speed of piston and plunger pumps by shifting belts or gears. In centrifugal-pump installations the same end is sometimes attained by operating a bank of pumps in simple multiple for the low heads and in compound "series" for the higher heads. For small units, particularly at the lower heads, the direct-connected centrifugal or turbine pump is a favorite on account of its simplicity and freedom from attendance. Many of these plants operate throughout the season of five months with inspection only at weekly or longer intervals.

Use of Outdoor-Type Substations

Although comparatively a young concern, the Wenatchee Valley Gas & Electric Company was, on account of the nature of this irrigation business, one of the pioneers in outdoor-type substation construction. Fig. 7 gives a good idea of the usual form of construction, and Fig. 6 shows a very small (20-kw) installation of the "birdhouse" type. In these outdoor substations the

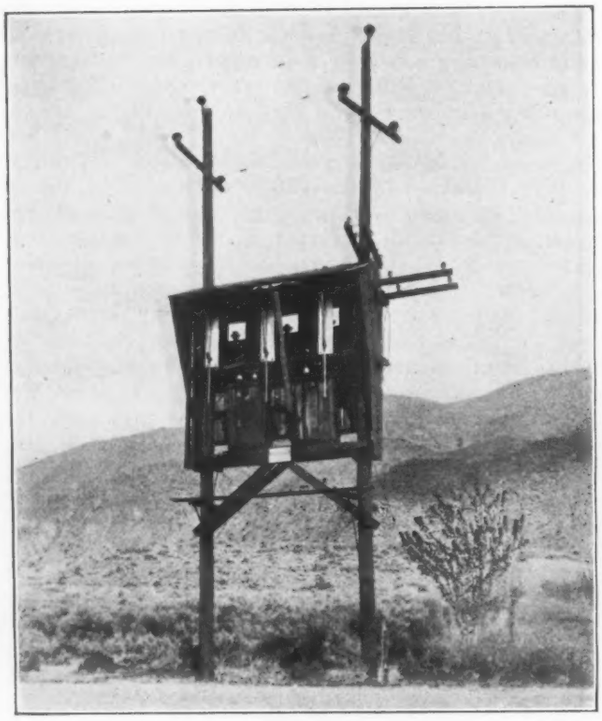


FIG. 6—"BIRDHOUSE" TYPE OF SMALLER OUTDOOR SUBSTATION

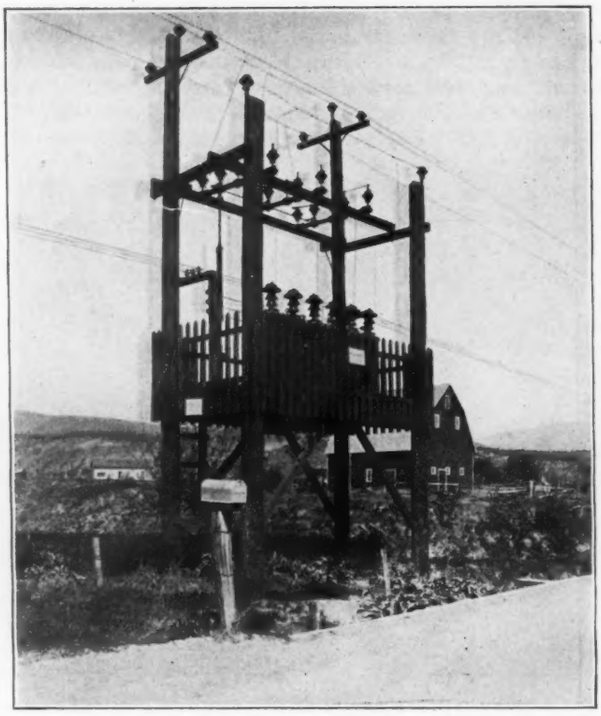


FIG. 7—STANDARD OUTDOOR INSTALLATION SERVING LARGER CUSTOMERS

FIG. 8—AS FAR AS THE EYE CAN SEE THESE EVENLY SPACED TAPS DELIVER WATER FROM THE CENTRAL PUMPING STATION TO THE LONG FURROWS IN THE ORCHARD

FIG. 9—DRYDEN POWER PLANT OF THE WENATCHEE ELECTRIC COMPANY

FIG. 10—USUAL "FURROW" METHOD EMPLOYED IN IRRIGATING ORCHARDS

transformers are protected by fused switches of the "air-break" pole-top type on the "high" side and by oil circuit-breakers on the "low" side. The pressures are 33,000 volts, 16,500 volts and 2200 volts. The protection thus afforded appears to be ample, for in several years' experience the company has not had trouble on a single

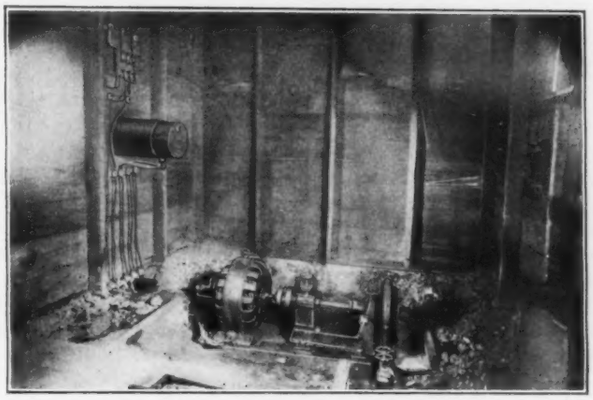


FIG. 11—DIRECTLY CONNECTED UNIT FOR SMALL INSTALLATION

"outdoor" high-tension transformer. Lightning arresters of the electrolytic pan type are also in use.

In consequence of the extension of the power lines into the country, the subject of electric lighting and motor service to farms assumes important proportions. The farmer—especially the irrigation farmer—is a liberal patron. Electric irons are universal; toasters, washing machines and all classes of domestic electric appliances are common, and feed cutters, cream separators and other farm machines are largely electric driven. The average annual return from the lighting of farm dwellings on the system exceeds by nearly one-third the average return from town and city dwellings. Many of the country lines, originally built for irrigation pumping, would now justify their existence from the lighting returns solely.

Electrical Ice-Making on the Pacific Coast

Probably the largest artificial ice-skating rink in the country is that at Portland, Ore., which has an ice floor measuring 311 ft. by 85 ft. In addition to furnishing refrigeration for this rink, the Portland Electric Ice Company operates an ice plant from which it is equipped to pull 100 tons of ice per day. The plant is motor-driven throughout and employs the raw-water process. Energy is purchased from the Portland Railway, Light & Power Company, which also furnishes power to operate the plant of the Crystal Ice & Storage Company of Portland. The latter company recently converted its refrigerating equipment from steam to electric drive, thereby effecting a saving of about $6,000 per year.

"Establishing Relations"

As electric service in a community develops the search for new business there becomes more strenuous for the salesman. The best business-getter, however, will be found to be the man with a multitude of "leads." How does he get them? According to Mr. Z. H. Stewart, chief lighting salesman of the Southern California Edison Company, Los Angeles, such leads are the direct result of "establishing relations." The butcher, the baker, the candlestick maker are all good fellows to get acquainted with—but particularly so is the little drug-store keeper on the outskirts of the town. He is usually the depositary for all the gossip and personal news of the surrounding neighborhood, and he can give the salesman many tips which lead to openings for new business.

Lifting the Mortgage by Electricity

BY R. B. MATEER

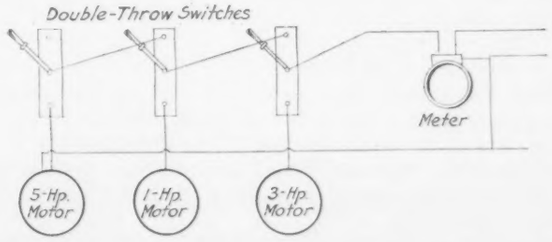
The advantages of electrically operated pumping plants and their value in connection with the irrigation of fruit lands are indicated by the large returns received from the sale of peaches in the Hemet district of southern California by the owner of a 10-acre tract. Two years ago a property consisting of 10 acres planted to bearing trees was purchased for the sum of $3,400. At that time a small mortgage of $1,000 was obtained from one of the local banks for the purpose of constructing a residence and installing an electrically operated pumping plant. A small portable house was easily arranged for residential purposes at an expense of $700. With a home established the next step was the drilling of a well, and at an expense of $356 a 7-ft. well (with casing) was sunk to a depth sufficient to provide a flow of water equivalent to 18 to 22 miner's inches.

A pumping plant consisting of a 5-hp motor, directly connected to a 2½-in. Byron-Jackson pump, was secured for $525. Pump and motor were placed in the pit at a depth of 40 ft. from the surface, and when in service gave all the water necessary for the irrigation of the acreage in question, and at the times when water was most needed.

Last year a total of 44 tons of peaches was marketed at a price of $25 per ton, returning to the fortunate owner $1,100, which sum is ample to lift the mortgage originally placed upon the property for the well and pumping equipment. Water formerly secured from ditch companies cost from $100 to $130 per season, while that pumped electrically cost only $60. Efficiency and assured economy—both were feasible with electricity as the motive power.

Keeping Down the Customer's Power Demand

One of the useful "wrinkles" worked out by the men of the Public Service Company of Northern Illinois to allow rural power users to have several motors and yet pay a low connected-load charge is shown in the accompanying sketch. Here an installation is diagrammatically represented which consists of a 3-hp motor, a 1-hp motor and a 5-hp motor, yet the greatest connected load that the customer can put on the line at any one time is 5 hp. Tracing the circuits through the three single-



INTERLOCKING CIRCUITS TO DECREASE CUSTOMER'S DEMAND

pole, double-thrown switches, it will be seen that it is impossible to connect more than one motor to the line at a time. This same scheme can, of course, be worked out for any number of motors of any size, in each instance the maximum demand of the installation being limited to the rating of the largest machine.

Selection of Switch Boxes for Knob-and-Tube Installations

BY ANTHONY GORMAN

In knob-and-tube work the National Electrical Code specifies that the mechanism for every flush switch must be inclosed in a sheet-metal box made in accordance with certain specifications which are outlined in

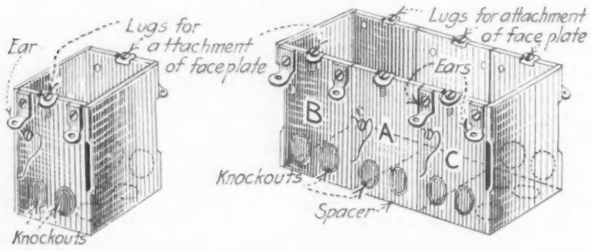


FIG. 1—SWITCH BOX WITH ONE REMOVABLE SIDE—SHOWN SINGLY AND ASSEMBLED IN A THREE-GANG GROUP

the code. Any of the switch boxes on the market approved by the Underwriters' Laboratories give satisfactory service where only one switch is to be installed at an outlet. However, where more than one switch is to be placed at an outlet—that is, where switches are to be mounted in gangs—the contractor can save himself some inconvenience if he selects a type of box that does not require a "filler" or "spacer" where the boxes are to be installed in gangs of more than two.

For example, if a box of the general construction of that shown at the left in Fig. 1 is used in gangs of more than two, as indicated at the right, a filler *A*—that is, a specially designed stamping—must be used between the two end stampings *B* and *C*.

However, if a box of the type shown in Fig. 2 is used, no filler is required, regardless of the number of sec-

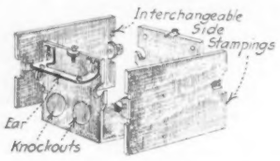


FIG. 2—BOX WITH INTERCHANGEABLE SIDES

tions assembled in a gang, since each of these boxes is so made that it itself constitutes a filler when the end stampings are removed.

The advantage of using a box like that of the general type used in Fig. 2 is obvious, in that with it special fillers are unnecessary and hence the contractor does not have to carry them in stock.

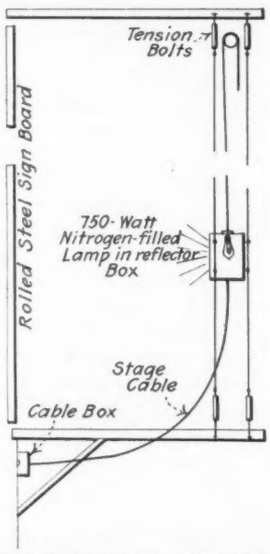
Provide Plenty of Shelf Room for Stock

For the proper care of stock, sufficient shelf room must be provided for those articles that are to be carried on shelves, and convenient bins arranged for heavy merchandise, declared Mr. Galen Crow, of Oklahoma City, before the recent convention of the Oklahoma electrical association.

A special set of shelves should be conveniently placed for lamps, a separate shelf or compartment for each size and type of lamp, and a test socket attached for the testing of every lamp that goes out of stock. The person making the sale will then know whether the lamp was actually in good condition when it left the storeroom, and the customer will see for himself the proper testing of the lamp. A cabinet with glass doors should be prominently placed in the front of the room and used for the protection and display of glassware and small devices. Where practicable, an appropriate showcase can be added for additional display of small devices and novelties.

Very Large Wall Sign Lighted by Twenty-four 750-Watt Gas-Filled Lamps

Taking advantage of a strategic location at the head of Michigan Avenue, Chicago's lake-front boulevard, the Chicago *Tribune* has there erected a huge painted steel sign covering the four upper stories of the five-story building, the roof of which is surmounted by the Federal Electric Company's motograph display. The new painted sign is lighted by twenty-four 750-watt nitrogen-filled lamps, mounted in reflectors suspended at a uniform distance of 10 ft. from the surface illuminated. A very uniform intensity over the entire surface, which measures 50 ft. by 100 ft., results from this careful spacing. The units are suspended in strings of three from steel brackets. By means of pulleys each group can be lowered for making renewals. Stage cables convey energy to each set of lamps. The reflectors are



METHOD OF HANGING LAMPS ON LARGE WALL SIGN

provided with eyes through which run the guying cables, two at the sides and one at the rear. By means of tension bolts these guide cables are made taut and prevent any possible swinging of the reflectors in the high winds which assail this location. The sign circuits are controlled by a electromagnet switch which is in turn actuated by a time switch of a few amperes rating, thus saving the outlay for the very large time switch necessary had it been attempted to control the sign circuit directly. The Thomas Cusack Company erected this display.

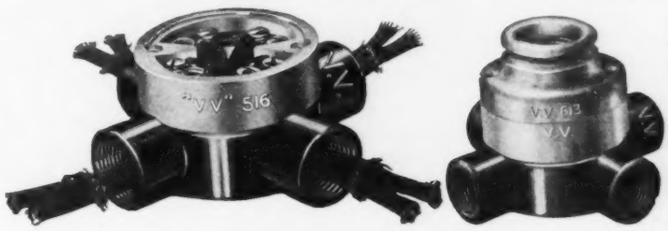
Lamps to Mark Islands of Safety

"Islands of safety," marked at each end with ornamental tungsten-lamp standards, have been constructed recently in the busiest section of the main thoroughfare of Newark, N. J., to protect persons boarding or alighting from street cars. The lamps are inclosed in green-glass globes and indicate distinctly where one may wait for a car without danger of being struck by passing vehicles. The 32-cp lamps are wired in series and are connected with the street-lighting circuits. The new "islands" are installed at intersections of main streets, at transfer points, and wherever traffic is unusually heavy.

NEW APPARATUS AND APPLIANCES

Fittings for Wiring Installations

A no-splice block with rosette cover and a no-splice block with receptacle, which have just been brought out by the V. V. Fittings Company, 1910 North Sixth Street, Philadelphia, Pa., are illustrated in Figs. 1 and 2 respectively. The no-splice block is designed to eliminate



FIGS. 1 AND 2—NO-SPLICE BLOCKS WITH ROSETTE COVER AND RECEPTACLE

the splicing of wires in conduit fittings and to do away with soldering and the making of rubber and tape splices. Blocks of this type are designed for use with rosette covers or porcelain-nipple covers and also No. 613 V. V. receptacles, as they are called. The receptacle fits directly on the no-splice block and no wiring is necessary, it is declared, after the no-splice block has been connected.

Another recent addition to the fittings made by the

FIGS. 3, 4 AND 5—FITTING WITH ANGLE PIECE, AND U AND Y FITTINGS

V. V. company is that shown in Fig. 3, which is provided with a 45-deg. bend and takes a receptacle as shown. A U-fitting and a Y-fitting are shown in Figs. 4 and 5. The fittings are designed for use with all No. 2 type 5 series porcelain and iron covers, as they are called, including Hubbell covers, concealed receptacle covers and various types of nipple covers.

Various covers have recently been brought out by the V. V. company for use with its so-called type P fittings. The covers are provided with single and double push-

FIGS. 6, 7 AND 8 — COVER WITH SINGLE PUSH-BUTTON SWITCH, AND CABINETS FOR CUT-OUTS

button switches, rotary switches, Hubbell plug receptacles and screw-plug receptacles. A cover fitted with a single push-button is illustrated in Fig. 6. Various kinds of type Y series fittings, as they are called, have also just been developed by the V. V. company, and they are built in different sizes to fit two-wire and three-wire cut-outs rated at from 30 amp to 100 amp. They are designed for use with cut-outs made by various manufacturers, leaving ample room, it is declared, for wiring connections. One of the cabinets is shown in Fig. 7.

A box arranged for cut-outs and having an extension for a snap switch to control the outlets of the cut-outs is shown in Fig. 8. The cabinet is designed for various sizes of conduit with outlets on all sides. Water-tight and dustproof boxes are also being made. They are designed to guard against mechanical injuries and to prevent the operators from coming in contact with live metal parts. The boxes are arranged with outlets on all sides and are designed to accommodate single and double-branch "New Code" or plug-fused cut-outs, and also 5-amp snap switches.

Portable Volt-Ammeter for Automobiles

A portable volt-ammeter designed especially for use with automobile lighting and starting systems is shown herewith. The instrument is mounted in an oak case and has a rugged mechanism designed especially to withstand rough usage. Three voltage scales are provided —zero to 3 volts in 0.05-volt divisions, for testing individual cells; zero to 15 volts in 0.25-volt divisions, for

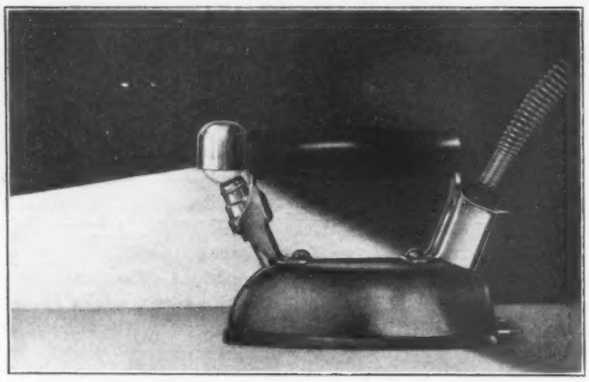
VOLT-AMMETER FOR AUTOMOBILE LIGHTING AND STARTING SYSTEMS

testing three-cell systems, and zero to 30 volts in 0.05-volt divisions, for use on systems employing six cells, nine cells or twelve cells. There are two ammeter scales, one scale ranging from 10 amp through zero to 35 amp, and the other from 100 amp through zero to 350 amp. The instrument is being placed on the market by the Roller-Smith Company, 203 Broadway, New York.

Electrically Illuminated Iron

An electric iron with a small tungsten lamp mounted in front of its handle is shown in the accompanying illustration. On account of the position of the lamp the iron has been named the "Hedlite" iron. Use is made of a 4 cp, 6-volt round-bulb tungsten lamp, but this tiny unit, on account of its proximity to the ironing board, gives more light on the board directly in front of the iron than would be obtained from several large lamps in a ceiling fixture. The lamp is provided

with a metal reflector which is about as large in diameter as the handle against which it fits. The reflector acts as a shield to keep the light from striking the eyes when the iron is in operating position. The lamp socket is supported by the front handle bracket, and the supply



ELECTRIC IRON EQUIPPED WITH SMALL TUNGSTEN LAMP

wires for the lamp are carried through a metal tube to the interior of the iron. The lamp burns whenever energy flows through the iron and thus incidentally serves as a pilot lamp. An iron thus equipped is especially desirable where there is only one outlet, as is frequently the case in apartments and small dwellings. The lamp and iron together take 500 watts. The iron is made in both tilting and non-tilting types and is being placed on the market by the Pittsburgh Electric Specialties Company, Pittsburgh, Pa.

Underload Circuit-Breaker

An underload circuit-breaker designed for use with small generating plants provided with storage batteries has been developed by the Roller-Smith Company, 203 Broadway, New York. The device is designed to protect the apparatus against reversal of current, and operates when the current is reduced to a predetermined minimum caused by approach of the condition of full

UNDERLOAD CIRCUIT-BREAKER FOR SMALL GENERATING PLANTS EQUIPPED WITH BATTERIES

charge, slowing down of the prime mover, or any of the other reasons for reversal of current. The circuit-breaker is so designed that it can be adjusted to take care of the special conditions of the installation. According to the manufacturer, the operation of the device is prompt and positive and the normal underload tripping point is 10 per cent of the circuit-breaker rating. Because of the fact that when an underload circuit-breaker trips it indicates either that the battery is fully charged or that there is some abnormal condition which should be investigated before the circuit is again closed, the device has been designed to be closed by hand. Circuit-breakers of the type described above are being made in single and multi-pole units, in both the plain underload and combined underload-overload type, of various ratings.

Flush Receptacle with Lift Cover

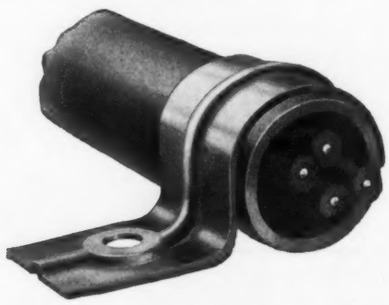
The flush receptacle shown herewith is of the lift-cover type and is provided with T-slots, by means of which there can be used with it any of the seventeen different kinds of caps made by the manufacturer, Harvey Hubbell, Inc., Bridgeport, Conn. When not in use, the receptacle presents a perfectly flush surface. A

LIFT-COVER FLUSH RECEPTACLE

special hinge arrangement causes the base of the cover to project slightly, permitting it to fall back at an angle against the plate. The arrangement makes it impossible, it is asserted, for the cover to drop down as a result of an unintentional jar.

Cable and Conduit Hanger

A clip for hanging cable and conduit called the "Jiffy" clip has recently been placed on the market by the Minerallac Electric Company, of 400 South Hoyne Avenue, Chicago, Ill. Only one bolt or screw is required to fasten in place both the clip and the conduit that it holds. A rib drawn lengthwise in the center of the clip adds to its strength, and a boss raised about the

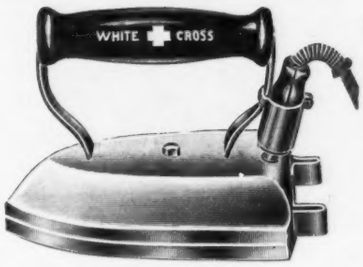


CLIP DESIGNED FOR QUICK APPLICATION IN HANGING CABLE AND CONDUIT

bolt hole serves as a lock washer and prevents the clip from working loose. These clips, finished in black japan or galvanized, are made for conduit and pipe of various sizes as follows: 0.375 in., 0.5 in., 0.75 in and 1 in.

Electric Iron

The electric iron shown herewith has just been developed by the Lindstrom, Smith Company, 1100 South Wabash Avenue, Chicago, Ill. It is so designed that the heat is conducted to the point and edges where it is most needed. The handle, according to the manufacturer, always remains cool. No stand is necessary, as the iron can be tipped back when not in use. The device is heavily nickel-plated and weighs 6 lb.



ELECTRIC IRON WHICH CAN BE TIPPED BACK WHEN NOT IN USE

Large Motor-Generator Set in San Francisco

To supply direct current in the business section of San Francisco the Pacific Gas & Electric Company has recently placed in commercial service a new motor-generator set which is said to be the largest unit of its kind in operation west of the Mississippi River. The set has an output of 2000 kw at 275 volts direct current and is of the two-bearing type, operating at 300 r.p.m. Use is made of a sixty-cycle synchronous motor which is wound for the full station pressure of 11,000 volts, the highest voltage allowed in the underground district of San Francisco.

The direct-current generator is shunt-wound and is of the commutating-pole type, having sixteen poles. The poles are of laminated steel and are securely bolted to the cast-steel magnetic yoke. Steel was used to reduce the weight of the yoke, while to give strength and rigidity the yoke is made of cored box section. The field coils are treated to render them impervious to oil and moisture. They are so arranged that there is a constant circulation of air around each coil, insuring cool operation. The coils on the commutating poles are of soft annealed strip copper wound on edge.

On account of the size and high peripheral speed of the commutator, the construction is similar to that employed in turbo-generators where the bars are arch-bound by three shrink rings having high tensile strength.

The commutator bars are of hard-drawn copper with mica insulation. The inner periphery of the commutator is bored at each end to a slight taper. These tapered ends of the bars rest on, but are insulated from, steel rings turned to the same angle. Through bolts of high tensile strength hold these tapered rings in place. This construction allows the commutator bars as they become heated to expand lengthwise without distorting the shape of the commutator.

A substantial brush yoke mounted on the base of the set carries a cast-iron ring to which the brush forks are attached. On account of the length of the studs which they carry, and to give rigidity, these forks are of cast iron and are copper-plated. All parts of the brush rigging are made comparatively heavy to absorb the small vibrations due to the action of the 250 brushes on the commutator.

Each armature conductor consists of eight square wires in multiple, insulated from each other to reduce the eddy current loss, which would be considerable with solid conductors of this size. The coils, which are insulated with mica, fish paper and cotton tape, are hot-pressed and impregnated in an oil-proof and moisture-proof compound. The arrangement of the coils on the armature is such, the manufacturer claims, as to afford ample ventilation. By using baffle plates on the front end of the commutator and rear end of the armature, the flow of air is directed to the energy-carrying parts, affording effective cooling, and at the same time reducing the windage loss. Box-type brush holders are employed, and they are split through the center and hinged on one side so that any holder can be removed without disturbing others on the same stud.

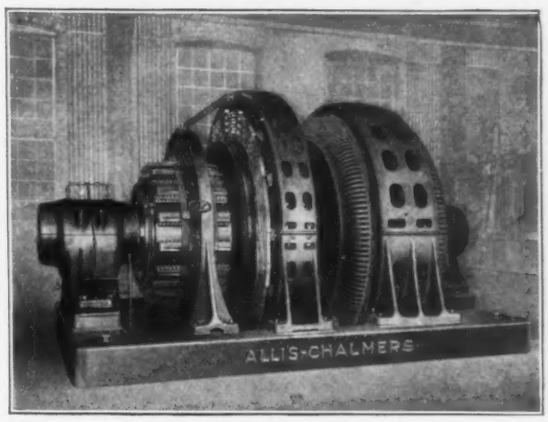
The rotor spider of the motor is of cast iron having a steel rim to which the pole pieces are dovetailed. With this construction all strains due to centrifugal force are taken by the steel rim, a casting of simple section, while shrinkage strains, which would exist in a one-piece spider cast with arms, are avoided.

The field coils consist of a single layer of soft annealed strip copper wound on edge and are designed for 275-volt excitation from the direct-current busbars. For damping the oscillations and to prevent hunting a low resistance "amortisseur" winding of the squirrel-cage type is used.

The rotor is provided with fans which serve only to direct the flow of the cooling air. With an inclosing shield on the side of the motor next to the generator, the air is taken in only at the bearing end and is directed around the poles and through the stator winding and core. Thus the motor as well as the generator has its independent system of ventilation.

Although the rotating element of the set weighs 46 tons, only two bearings are utilized. Each pedestal is provided with a large oil reservoir with openings for the circulation of air for cooling. The bearings are ring-oiled, but to insure a copious supply of oil the system of flooding is used. Each bearing is provided with a small gear pump, belted to the shaft, which carries oil from the reservoir in the pedestal and floods it into the top of the bearings.

The motor-generator set was designed and built by the Allis-Chalmers Manufacturing Company, Milwaukee, Wis. It occupies a floor space measuring 13.5 ft. by 21 ft., and is installed in the Pacific Gas & Electric Company's station C in the center of the business district.



2000-KW MOTOR-GENERATOR OUTFIT

The set, together with other motor-generator outfits in the same station, is used in charging a large storage battery which carries the peak loads in the commercial section of the city.

Ten-Inch Ventilating Fan

The fan shown herewith is designed to operate either as a blower or an exhaust fan. It is driven by a fully inclosed motor which operates at 1750 r.p.m. At operating speeds the rated air movement of the fan is from 800 cu. ft. to 900 cu. ft. per minute. With inlets of restricted area the output is reduced to about 500 cu. ft.

TEN-INCH, TEN-BLADE EXHAUST FAN

a minute. Thrust bearings are provided to permit of vertical as well as horizontal operation. The fan is stamped from a single sheet of brass and is equipped with ten blades. It is riveted to a turned-brass hub. Oufits are being made for operation on 85-volt, 110-volt or 220-volt direct current and 110-volt or 220-volt alternating current. The fan has been developed by the Vacuum Car Ventilating Company, Chicago, Ill., a Robbins & Myers motor being employed to run it.

Electric Water Heater

A device which can be attached to an ordinary house water pipe, and which is designed to give a continuous flow of boiling water, is shown in the accompanying illustration. It weighs 20 oz. and measures 3⅛ in. wide, ⅝ in. thick and 4.25 in. high. The heater operates on either alternating current or direct current at 110 volts. Both the flow of water and the flow of elec-

SMALL ELECTRIC WATER HEATER ATTACHED TO WATER PIPE

trical energy are controlled by the movement of the faucet handle. To secure hot water the handle is turned to the left. If cold water is desired, it is turned to the right. When the handle is in the center position both the water and energy flow are shut off. The device is nickel-plated and is being made by the Sterling Corporation, 1276 West Third Street, Cleveland, Ohio.

Electrically Operated Swing Saw

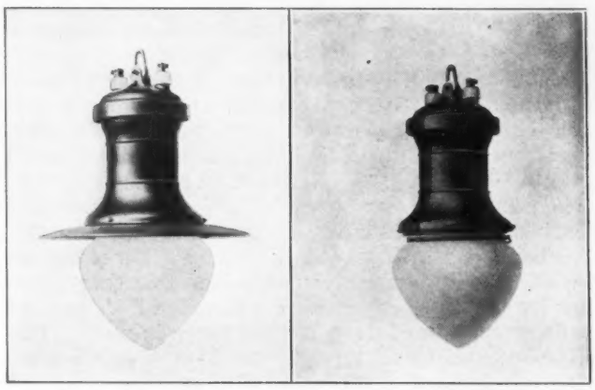
The swing saw shown herewith has been developed especially for use in factory shipping rooms for the preparation of crating lumber. The motor and saw are combined into a single unit. According to the manu-

MOTOR-DRIVEN SWING SAW

facturer, the Reno-Kaetker Electric Company, 610 Baymiller Street, Cincinnati, Ohio, the device can be placed in almost any location and may be attached with four bolts. Energy is taken only when the saw is in operation, a snap switch opening the circuit when the operation is finished.

Fixtures for High-Efficiency Incandescent Lamps

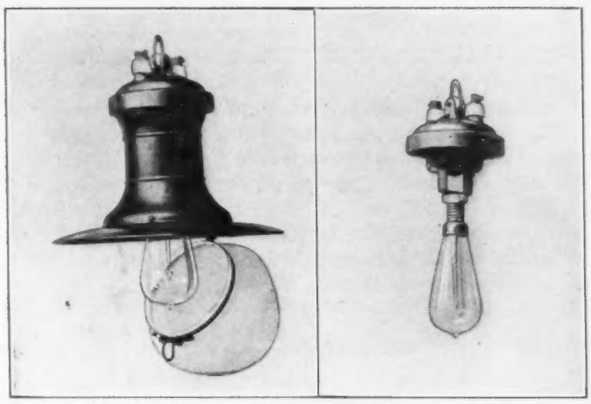
Street-lighting fixtures for gas-filled incandescent lamps, with ample provision for good ventilation and protection from rain and snow, have recently been developed by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., as shown herewith. All openings are covered with screening to exclude insects.



FIGS. 1 AND 2—FIXTURE WITH AND WITHOUT REFLECTOR

An acorn-shaped diffusing globe is provided to reduce the glare of the lamps. According to the manufacturer, the fixture has been designed with a view to maximum durability and accessibility. The case is of solid copper and is finished in black enamel. The globe is hinged at one side and latched at the other by means of a corrugated band of copper, thus permitting the replacement of

lamps with only one hand. A specially designed skeleton socket is employed with the fixture. The unit has been designed primarily for use with a high-current lamp (usually 15 amp and 20 amp), and is equipped with a



FIGS. 3 AND 4—FIXTURE WITH GLOBE LOWERED, AND WITH GLOBE AND CASING REMOVED

core-type auto-transformer so that it can be employed on 6.6-amp and 7.5-amp constant-current alternating-current circuits. The winding of the transformer is insulated from the coil by micarta washers and the complete unit is thoroughly impregnated with bakelite. In Fig. 1 is shown a fixture without reflector, and in Fig. 2 a unit with a 20-in. reflector. In Fig. 4 the fixture is shown with globe and case removed. The units are called "luxsolite" fixtures.

Electric Headlamps for Mine Locomotives

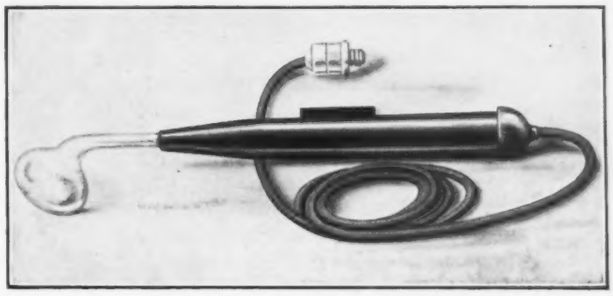
The electrically operated headlamp shown herewith consists essentially of a metal case, a 7-in. mirrored-glass reflector and a tungsten lamp which is so suspended that the constant "pounding" of mine-locomotive service, for which the device is designed, will not break the filament. The manufacturers assert that the headlamp is practically dust-proof and watertight. The total weight of the device is 13 lb. All metal parts are of drawn sheet steel, electrically welded and finished inside and out in baked black enamel. Handle and supports are provided as shown, and use is made of a grid door to prevent front-glass breakage. The "golden

MINE LOCOMOTIVE HEADLAMP

glow" lamp, as it is called, is particularly adapted for use where glare or dazzling light is to be avoided. It is claimed that with a 23-watt lamp a man can be seen on the track more than 425 ft. ahead, and with a 36-watt bulb 600 ft. ahead, of the locomotive. The headlamp is being made by the Esterline Company, Indianapolis, Ind.

Electro-Medical Apparatus

A complete "violet-ray" high-frequency generator with vacuum-glass electrode is shown in the accompanying illustration. It is provided with cord and socket, as shown, for connection to any ordinary lighting socket and can be operated on either alternating current or direct current. When in operation a violet glow is produced in the glass electrode. The device has been particularly recommended for use in treating scalp diseases



SMALL SELF-CONTAINED HIGH-FREQUENCY GENERATOR

and for facial treatments. It is controlled by a slide switch and is made by the Shelton Electric Company, Forty-second Street Building, New York.

Non-Glare Lens for Electric Headlamps

A safety lens, as it is called, for electric automobile headlamps, which is placed in the lamp in exactly the same way as an ordinary front glass, is shown herewith. The glass is recessed as shown, the depressions being of clear glass and the other parts of treated glass. As a

SECTIONAL VIEW OF LENS FOR DIFFUSING RAYS

result, the manufacturer claims, the rays from the lamp are diffused in such a way that no glare is produced. The rays passing through the clear glass are reflected, it is explained, to the side, while the direct rays pass through the translucent glass. The device is being placed on the market by the Lancaster Lens Company, Lancaster, Ohio.

CURRENT NEWS SECTION

Bureau of Standards Postpones Conference on Safety Rules

Because of unavoidable delay in meeting the demands for copies of Circular No. 54, and in order to permit the fullest opportunity for those interested to study and criticise the proposed National Electrical Safety Code, the Bureau of Standards has postponed the date for the proposed conference in Washington from July 1 and 2, the time announced originally, to Oct. 27.

President Scott of the National Electric Light Association has appointed the following committee to represent the association in matters connected with the Bureau of Standards: Messrs. W. H. Blood, Jr., chairman, S. G. Rhodes and R. J. McClelland.

A. I. E. E. Annual Convention

At the annual convention of the American Institute of Electrical Engineers, to be held at Deer Park, Md., from June 29 to July 2, the opening address will be delivered by President Paul M. Lincoln, after which the following papers will be read and discussed:

"The Electrical Strength of Air," by Dr. John B. Whitehead; "The Reluctance of Some Irregular Magnetic Fields," by Mr. John F. H. Douglas; "Irregular Wave-Forms," by Dr. Frederick Bedell, assisted by Messrs. R. Brown, H. A. Pidgeon, C. L. Swisher and F. M. Mizuski; a symposium on foundations for transmission-line towers, by Messrs. J. A. Walls, J. B. Leeper, W. E. Mitchell, P. M. Downing and F. C. Connery; a topical discussion on fields of motor application will be opened by Mr. D. B. Rushmore; a paper on "Electricity in Grain Elevators" will be read by Mr. H. E. Stafford; "Classification of Alternating-Current Motors," by Mr. Val A. Fynn; "The Classification of Electromagnetic Machinery," by Mr. Frederick Creedy; "Short-Circuits on Alternators," by Prof. Comfort A. Adams; "The Effective Illumination of Streets," by Mr. Preston S. Millar; "Systems of Street Illumination," by Dr. Charles P. Steinmetz; "Construction and Maintenance Costs of Overhead-Contact Systems," Part I by Mr. E. J. Amberg, Part II by Mr. Ferdinand Zogbaum; "Contact System of the Butte, Anaconda & Pacific Railway," by Mr. J. B. Cox; "Third-Rail and Trolley System of the West Jersey & Seashore Railroad," by Mr. J. V. B. Duer; "Unprotected Top-Contact Rail for 600-Volt Traction System," by Mr. Charles H. Jones; "Contact Conductors and Collectors for Electric Railways," by Mr. C. J. Hixson; "Contact System of the Southern Pacific Company, Portland Division," by Mr. Paul Lebenbaum; "Phase Angle of Series Transformers," by Mr. Chester L. Dawes; "Calibration of Series Transformers by Means of Mutual Inductances," by Mr. Charles L. Fortescue; "The Induction Watt-Hour Meter," by Prof. V. L. Hollister; "The Measurement of Dielectric Losses with the Cathode Ray Tube," by Mr. John P. Minton; "Economic Operation of Electric Ovens," by Mr. Percy W. Gumaer, and "Class Rates for Electric Light and Power Systems of Territories," by Mr. Frank G. Baum.

During the convention the official headquarters of the Institute will be at Deer Park Hotel, where the technical sessions will be held. Arrangements have been made for the usual entertainment features, including a golf tournament, competition for the Mershon Cup, baseball, tennis, bowling and special events for the ladies in attendance. Mr. John H. Finney is chairman of the general convention committee, and Mr. L. T. Robinson is chairman of the meetings and papers committee.

"Electrical Prosperity Week" Sectional Committees

Sectional committees to supervise the "Electrical Prosperity Week" campaign have been appointed by the executive committee in charge of the movement. Nearly 200 men, representing the various branches of the electrical industry, have been invited to take charge of local campaigns in various cities. The executive committee consists of Messrs. A. W. Burchard, vice-president General Electric Company, chairman; Frank W. Smith, vice-president United Electric Light & Power Company, New York; Gerard Swope, vice-president Western Electric Company; J. R. Strong, president Tucker Electric Construction Company; Hugh M. Wilson, ELECTRICAL WORLD, and, ex officio, J. M. Wakeman, general manager, and H. W. Alexander of the Society for Electrical Development. Other names will be added to the district committees as the campaign progresses.

The local committees are composed of representatives of the manufacturers, electric central-station companies, contractors and jobbers. These committees, co-operating with the Society for Electrical Development, will designate additional committees in smaller cities and towns in the respective districts and the campaign will be under full headway about Aug. 1.

Pledges of support have been received at the executive offices of the society, New York, from leading industries in other fields. City officials have pledged co-operation in the movement. The St. Louis Jovian League of Electrical Interests has appointed Mr. Fred Johnson, vice-president, chairman of a committee of ten to perfect suitable plans for "Electrical Prosperity Week."

The committeemen in charge of local campaigns are as follows:

Arkansas—Messrs. S. E. Dillon, C. J. Griffith and W. J. O'Brien.

Atlanta, Ga.—Messrs. E. J. Wallis, W. Rawson Collier, W. M. Rosborough, L. L. Shivers and D. H. Braymer.

Baltimore, Md.—Messrs. H. A. Wagner and John G. Johannesen.

Birmingham, Ala.—Messrs. Oscar C. Turner, R. T. Brooke, F. T. Pellens, H. W. Matthews, J. R. Wilcox and Ben F. Noble.

Boston, Mass.—Messrs. Charles L. Edgar, W. H. Atkins, L. D. Gibbs, Frank S. Price, James I. Ayer and H. B. Gilmore.

Buffalo, N. Y.—Messrs. W. E. Robertson and Roy R. Wiley.

Butte, Mont.—Mr. H. W. Turner.

Chicago, Ill.—Messrs. Samuel Insull, Ernest Freeman, Edward N. Hurley, T. J. McGill, W. W. Low, Homer E. Niesz, F. A. Ketcham and A. A. Gray.

Cincinnati, Ohio—Messrs. W. W. Freeman, L. T. Milner, W. G. Reuter, C. M. Crofoot and J. A. Brett.

Columbus, Ohio—Messrs. F. S. Terry, Samuel Scovil, J. M. Bateman, George S. Vail, George S. Milnor, J. S. Crider and M. G. Buchan.

Dallas, Tex.—Messrs. Charles F. Wallace, W. J. Drury, R. C. Brooks, C. W. Davis, H. S. Cooper and Charles A. Newning.

Dayton, Ohio—Messrs. F. M. Tait and T. F. Kelly.

Denver, Col.—Messrs. W. J. Barker, L. M. Cargo, P. A. Brown, R. W. Nichol, R. Arnold Lewis and Alexander Brown.

Detroit, Mich.—Messrs. Ernest McCleary, Frank Kuhn, B. D. Horton, L. N. Pyle, Frank Hilton and F. H. Van Gorder.

Duluth, Minn.—Mr. A. W. Lindgren.

Elmira, N. Y.—Mr. Frederic H. Hill.

Iowa—Messrs. E. M. Walker, W. J. Ball, L. L. Kellogg, George O. May, W. H. Thomson, Jr., E. L. Barr and Benjamin McInnerney.

Indianapolis, Ind.—Messrs. G. M. Sanborn, T. B. Hatfield, Harry Payne and A. M. King.

Kansas City, Mo.—Messrs. F. B. Uhrig, F. H. Van Brunt, J. S. Tritle, William Hand and A. P. Denton.

Los Angeles, Cal.—Messrs. S. M. Kennedy, J. C. Rendler, K. E. Van Kuran, T. E. Burger, Carl E. Johnson, J. O. Case, F. H. Trimble and H. B. Woodill.

Louisville, Ky.—Mr. James Clark, Jr.

Milwaukee, Wis.—Messrs. H. P. Andrae, S. B. Way, W. H. Tomkins, E. A. Quarfot, R. M. Van Vleet and A. L. Pond.

Mobile, Ala.—Mr. T. K. Jackson.

Minneapolis-St. Paul, Minn.—Messrs. J. M. Hannaford, Jr., W. H. Vilett, J. L. Barnard and C. D. Wilkinson.

Newark, N. J.—Messrs. R. R. Young, C. A. S. Howlett and Benjamin Hurd.

New Orleans, La.—Messrs. M. S. Sloan, C. Robert Churchill, B. Willard and E. H. McFall.

New Mexico—Messrs. W. P. Southard, C. M. Einhart and E. A. Theile.

Omaha, Neb.—Messrs. H. N. Goodell, R. A. Swain and H. F. Viot.

Philadelphia, Pa.—Messrs. J. B. McCall, Washington Devereux, Gilbert S. Smith and A. L. Hallstrom.

Pittsburgh, Pa.—Messrs. L. A. Osborne, J. C. McQuiston, Carl Peirce, Jr., C. E. Corrigan, R. S. Orr and L. M. Dunn.

Portland, Ore.—Messrs. J. A. Cranston, F. C. Green and F. N. Averill.

Richmond, Va.—Messrs. H. W. Hall, Edgar M. Andrews, George A. Tower and Peter Winston.

Rochester, N. Y.—Messrs. Robert M. Searle and C. Wheeler.

St. Louis, Mo.—Messrs. W. A. Layman, A. C. Einstein, Fred B. Adam, F. N. Boyer, William Clegg, Jr., and George E. Cullinan.

Salt Lake City, Utah—Messrs. William W. Torrence, A. R. Loughborough and E. H. Eardley.

San Francisco, Cal.—Messrs. John A. Britton, George C. Holberton, W. S. Hanbridge, F. H. Leggett, W. W. Briggs, Thomas Addison and Carl E. Heise.

Savannah, Ga.—Messrs. Edward S. Roberts and F. M. Byrne.

Seattle, Wash.—Messrs. A. W. Leonard, George R. Cooley and J. I. Colwell.

Spokane, Wash.—Mr. D. L. Huntington.

Syracuse, N. Y.—Messrs. A. F. Hills, J. C. De Long, T. L. Schrantz, A. M. Little, Harvey N. Smith and F. S. Baldwin.

Tennessee—Messrs. J. P. Lawrence, F. H. Cantrell, W. C. Teas, Emmett Scott, Herman Schenck, A. Greenwood and W. R. Herstein.

Toledo, Ohio—Messrs. Frank R. Coates and F. Bissell.

Tucson, Ariz.—Mr. Frank E. Russell.

Chinese Commission Inspects Electrical Plants

The Honorary Commercial Commission of the Republic of China, which is making a tour of the United States in the interest of closer trade relations between the two countries, was in New York City from June 1 to 8, and the members visited many industries in the city and surrounding districts. Since the commission reached this country it has inspected many industrial establishments, including various electrical manufacturing concerns. The plant of Thomas A. Edison, Inc., at Orange, N. J., was visited on June 8. The commission has also inspected the plant of the Western Electric Company in Chicago and the offices of the same company in New York. It visited the Westinghouse Electric & Manufacturing Company works at East Pittsburgh, Pa., and on the return trip to the West will inspect the plant of the General Electric Company at Schenectady, N. Y. Some of the members of the commission or of their party have also visited central stations. Mr. Silvanus T. Suen, electrical engineer and graduate of the University of Wisconsin, is interpreter for the commission.

The commission spent the entire day of June 8 at the plant of Thomas A. Edison, Inc., traveling in a special train directly to the establishment. The members of the commission were received by Mr. Edison in the laboratory and were then taken by Mr. M. R. Hutchison, chief engineer, on a tour of the buildings. The morning was spent in the Edison Storage Battery Company building. The members of the commission and the large party accompanying them were entertained at lunch and afterward viewed educational, comic and talking moving pictures. The guests also saw a demonstration of the machine that records telephone conversations.

Electrical Opportunities in China

China presents an exceptional opportunity now for American manufacturers of electrical machinery and appliances, according to Mr. J. H. Lee, electrical engineer and manager of the Lee Brothers Importing & Exporting Company of Shanghai, China. Mr. Lee is a member of the Chinese commission. In talking with a representative of the ELECTRICAL WORLD he outlined how the European war had affected the electrical supply business in China. For instance, his company formerly handled exclusively wire made in Austria. That source being shut off and no other having developed, the price of the wire required to meet the Chinese demand has increased to nearly three times what it was at the beginning of the war. Many other electrical products have been affected similarly.

The previous inability or lack of desire of American electrical manufacturers to compete in price with European producers was mentioned by Mr. Lee. He also stated that American goods were usually of better quality than the Chinese market demanded. He considers that the price handicap has been overcome, perhaps permanently, by other conditions, and that manufacturers of the United States are evidencing a desire to meet the lower quality requirements of the Far Eastern trade.

Mr. Lee has made arrangements to represent several American manufacturers of electrical machinery, supplies and appliances in China. He also is negotiating with other concerns. It is his plan to supplant all his previous European accounts with American connections.

Two central generating stations, one of 2000-kw. rating at Hangchow and one of 1000-kw rating at Ningpo, are controlled by interests with which Mr. Lee is associated. He called attention to the fact that, although few central stations have been built in China, there are many opportunities for additional plants. The fact that energy is used now almost exclusively for

lighting does not keep Mr. Lee from the conviction that there is a large field for motor-service purposes as a result of impending industrial developments.

Although the members of the commission left New York for Boston on June 8, Mr. Lee decided to remain in New York for two or three weeks and to join the party later.

Dr. Steinmetz Elected Next President of Illuminating Engineering Society

At the recent election held by the Illuminating Engineering Society the following officers of the society and of its several sections were elected for various terms beginning Oct. 1, 1915:

President, Dr. C. P. Steinmetz; general secretary, Mr. Alten S. Miller; treasurer, Mr. L. B. Marks; vice-presidents, Mr. Clarence L. Law and Mr. J. L. Minick; directors, Mr. W. A. Durgin, Mr. M. Luckiesh and Mr. J. Arnold Norcross.

Chicago Section: Chairman, Mr. E. W. Lloyd; secretary, Mr. O. L. Johnson; managers, Messrs. A. O. Dicker, H. M. Frantz, C. A. Luther, A. H. Meyer and F. A. Rogers.

New England Section: Chairman, Dr. Louis Bell; secretary, Mr. S. C. Rogers; managers, Messrs. J. W. Cowles, W. B. Lancaster, George P. Smith, Jr., H. F. Wallace and R. C. Ware.

New York Section: Chairman, Mr. D. McFarlan Moore; secretary, Mr. Norman D. Macdonald; managers, Messrs. Thomas M. Ambler, L. H. Graves, W. F. Little, E. R. Treverton and Herbert S. Whiting.

Philadelphia Section: Chairman, Mr. George S. Crampton; secretary, Mr. L. B. Eichengreen; managers, Messrs. George S. Barrows, Douglass Burnett, C. E. Clewell, R. B. Ely and C. E. Ferree.

Pittsburgh Section: Chairman, Mr. Lewis J. Kiefer; secretary, Mr. R. H. Skinner; managers, Messrs. Henry Harris, H. S. Hower, Harold Kirschberg, H. H. Magdsick and G. W. Roosa.

The proposals to amend the constitution of the society were also adopted by a vote of more than six to one. The principal amendments include provisions which create a grade of membership to be known as "members." The requirements for admission to this grade, as at present set forth, are somewhat higher than those of the other grade of individual members, to be known as "associate members." The annual dues of members will be $10 and of associate members $5.

The achievements in this country of Dr. Charles Proteus Steinmetz, who will take office as president of the Illuminating Engineering Society next October, are well known to nearly everyone in the electrical industry, although comparatively little has been published of his early life and his connection with political affairs in Germany. He was born at Breslau, Germany, in 1865, and was educated in the local "gymnasium" or preparatory school, and later at the University of Breslau, where he studied mathematics, astronomy, physics, chemistry and, for a short time, medicine and political economy. While still in college he became interested in socialism, writing articles on the subject and editing one of the socialist journals. Some of his scorching comments aroused the secret-service police, who attempted to arrest him, but by a ruse he escaped to Switzerland, where he entered the Polytechnische at Zürich and there studied mechanical engineering.

In 1889 he decided to go to the United States. Securing letters of introduction, he sailed for New York City, where, unheralded by any reputation, he received several rebuffs in his search for work, but was finally employed by the Osterheld & Eichemeyer Manufacturing Company as draftsman. His experiments with iron to determine its magnetic characteristics attracted the interest of his employers, who shortly afterward promoted him to be electrical engineer and designer. When the Eichemeyer interests were absorbed by the General Electric Company Steinmetz was retained by the latter in its calculating department at Lynn, Mass. In 1894, when the company's headquarters were transferred to Schenectady, he was placed in charge of calculations, design, research and development. For a number of years Dr. Steinmetz was professor of electrical engineering at Union College, Schenectady. In 1902 Harvard University conferred the degree of master of arts on him, and in 1903 Union College, Schenectady, honored him with the degree of doctor of philosophy. At present Dr. Steinmetz is in charge of the General Electric Company's consulting engineering department and occupies the chair of electrophysics at Union College.

The story is recounted that once when the General Electric Company offered to increase his salary, he objected, urging that the money be divided among the men in the shops. This was done, and it is reported

DR. CHARLES P. STEINMETZ

that he has more namesakes than anyone else in Schenectady. Dr. Steinmetz has written and lectured on a range of scientific subjects as widely diversified as the fields of the many sciences in which he has been a leader of investigation. Many of his papers on electrical subjects have been presented before the American Institute of Electrical Engineers. Among his principal books are "Astronomy and Meteorology," "Theory and Calculation of Alternating-Current Phenomena," "Theoretical Elements of Electrical Engineering," "General Lectures on Electrical Engineering," "Theory and Calculation of Transient Electric Phenomena and Oscillations," "Radiation, Light and Illumination," "Electrical Engineering Mathematics," and "Electric Discharges, Waves and Impulses." Dr. Steinmetz has from time to time served at the head of numerous social and technical organizations in this country, chief among which are the American Institute of Electrical Engineers, of which he is a past-president; the International Electrical Congress planned for San Francisco in September, but postponed by reason of the European war, of which he is

honorary president; the National Association of Corporation Schools, of which he is president, and the International Association of Municipal Electricians, of which he is vice-president. He is a fellow of the American Institute of Electrical Engineers and the American Association for the Advancement of Science, and a member of the British Institution of Electrical Engineers and the American Society of Mechanical Engineers.

National Electrical Contractors' Association Convention Program

As stated previously in the ELECTRICAL WORLD, the fifteenth annual convention of the National Electrical Contractors' Association will be held in San Francisco, Cal., on July 21 to 24. The special train for the convention, which is to leave New York via the New York Central Railroad at 5:30 p.m. on Saturday, July 10, is due to arrive in San Francisco at 9:55 a.m. on Sunday, July 18. The reception committee and officials of the California Association of Electrical Contractors and Dealers will meet the party at Richmond Pier. After crossing the bay the party will find automobiles waiting to take members to hotels.

On July 19 executive meetings of the California Association of Electrical Contractors and Dealers will be held and all national members are invited to be present. A session will be held at the Auditorium at 9 a.m. and a regular meeting at 1 p.m.

On July 20 a meeting of directors and the executive committee of the national association will be held, beginning at 10 a.m. at the Clift Hotel. A dinner and the regular monthly meeting of the California association will be held at the Clift Hotel at 6:30 p.m. The principal speaker will be Mr. W. L. Goodwin, vice-president and general sales manager of the Pacific States Electric Company, who will speak on "Co-operation Between Contractors and Jobbers."

On July 21 an open session will be held at the Auditorium, beginning at 10 a.m. Addresses will be made by Messrs. C. F. Butte, president of the San Francisco association; John R. Galloway, president National Electrical Contractors' Association; C. V. Schneider, president California Association of Electrical Contractors and Dealers; James Rolph, Jr., Mayor of San Francisco; John A. Britton, vice-president and general manager Pacific Gas & Electric Company; C. C. Moore, director-general Panama-Pacific International Exposition; George B. Muldaur, Society for Electrical Development, Inc., and Thomas A. Addison, Pacific Coast manager General Electric Company. A business session will be held at 2:30 p.m. and a reception and dance at the Clift Hotel at 9 p.m.

On July 22 a business session will be held at 10 a.m. at the Auditorium. Beginning at 2 p.m., there will be an automobile ride for ladies and guests through Golden Gate Park and the Presidio. At 2:30 p.m. a business session will be held in the Auditorium. The evening is National Electrical Contractors' night at "the Zone," the amusement center of the exposition

On July 23 a final business session will be held, beginning at 10 a.m., at the Auditorium. The board of directors will meet at the Clift Hotel at 2:30 p.m. and the executive committee at the same hotel at 3:30 p.m. At 7 p.m. in the evening there will be a dinner dance and vaudeville entertainment at Pompeian Court.

On Saturday, July 24, beginning at 9 a.m., there will be a trip by special steamer around San Francisco Bay and through the Golden Gate. The party will land at the Exposition grounds early in the afternoon.

Mr. James R. Strong, New York, is chairman of the convention committee of the national association. The following chairmen of local committees represent the California association: Messrs. W. S. Hanbridge, general; C. F. Butte, financial; W. D. Kohlwey, reception and dance; M. Fortini, boat ride; George A. Sittman, lunch on boat ride; W. H. Kirsten, dinner-dance; L. R. Boynton, auto rides; N. M. Hope, open meeting; H. C. Reid, reception; A. L. Hughes, "Zone"; C. L. Chamblin, Exposition; George Smith, music; L. B. Gilpin, Oakland; A. H. Brainager, decoration; J. E. Kenney, housing, and W. S. Hanbridge, press and publicity.

Data on Municipal-Plant Operation in Oklahoma

Exhaustive data have been collected by Prof. H. V. Bozell, consulting engineer, and director of the school of electrical engineering of the University of Oklahoma, Norman, Okla., on the equipment and details of engineering and financial operation of twenty-six of the larger municipally owned water and lighting plants in Oklahoma. Among the plants for which data were obtained were those at Blackwell, Cherokee, Claremore, Clinton, Cordell, Durant, Edmond, Fairview, Kingfisher, Lehigh, Marlow, Newkirk, Pawhuska, Pawnee, Perry, Ponca City, Purcell, Sallisaw, Sayre, Snyder, Stillwater, Tonkawa, Wagoner, Weatherford, Woodward and Wynne Wood. Professor Bozell's investigation was undertaken in order that the various municipally owned plants might be compared in all of their characteristics with one another, and also that the municipal plants might be compared with privately owned plants on any basis which might be later chosen.

In the introduction to his lengthy compilation of figures, the author remarks that almost all of these municipal plants showing inefficient operation and poor accounting are in towns which are governed by councils. At the end of each of the twenty-six individual plant reports Professor Bozell has inserted a syllabus or "Modification of Financial Statement" in which he assigns as charges to the expense side of the ledger certain expenses assumed by privately owned plants but often omitted by municipal-plant accountants; namely, sufficient depreciation, bond interest, sinking fund, etc. This modification was thought to be necessary if municipal water and lighting plants were to be examined as self-supporting.

Too often the success or failure of the municipal plants was found to be judged on the basis of the cash balance only. In practically every case where a cash surplus of any size was revealed, as well as in every case in which efficient operation and an intelligible accounting system were found, there proved to be someone in the municipality who was devoting a large part of his time to the handling of the plant without any charge to the municipality. Unless the community has seen fit to establish the water and lighting department as a separate organization, under a manager, it is usually a failure.

Another reason cited by Professor Bozell to explain why municipal plants usually show less efficient operation and management than privately owned plants is based upon purely engineering grounds. The private owner has usually had such experience himself that he realizes his own limitations in his knowledge of his methods of operation. He therefore secures and follows the advice of an experienced engineer who can show him methods of cutting costs of operation and of getting the most for every dollar expended. The municipality, on the other hand, seems loath to go outside of its own boundaries for advice of this nature. No one administration remains in charge long enough to learn its limitations, and each new administration expects to

better conditions by changing them. There is, therefore, declares the author, lack of uniform or continued policy of operation in the plant. The city-manager form of government, declares Professor Bozell in the report, tends to produce a condition similar to the businesslike methods of private ownership, and even in cities where municipal ownership seems to be the greatest success it is admitted that city managership will result in increased efficiency on account of the non-political and continuous character of the local government.

Increases in Coal Cost in England

At a joint conference of representatives of English gas and electrical industries held recently in London resolutions were adopted congratulating the government on the appointment of a committee to deal with the exportation of coal and expressing the hope that this may be effective in limiting exports. The resolutions also express the deepest concern in regard to the depleted stocks of coal and the difficulty under present conditions of renewing them for present and future requirements, and urge the government to take further steps to increase output, to give greater facilities for transportation, and to have regard in requisitioning steam colliers for the requirements of public utility undertakings. The government was asked to take such steps as may be necessary to reduce coal prices to a reasonable limit. A representative deputation was appointed to present the matter to Parliament.

Many electrical and gas undertakings have increased rates because of the difficulty in getting coal and advances in cost.

The Value of Spanish in Latin-American Trade

At the recent Pan-American financial conference, which was conducted along lines most gratifying to the important statesmen, financiers and business men from the nineteen countries represented, politics was completely sidetracked. The group conferences which occupied most of the time during the week in Washington were handled as strictly business meetings. Each of them was attended by a few representatives of the respective country and several financiers and business men as United States delegates. Each group got right down to cases regarding the hindrances to broader trade relations between the country in question and this nation. Need of more and better steamship lines, capital requirements, lack of mutual understanding of business methods and similar subjects were discussed specifically. Thus the foundation was laid for the work of several permanent international commissions which are to continue the elimination of all such hindrances to reciprocal trade between the United States and the countries to the south.

The lack of any knowledge of Spanish on the part of most of the United States representatives at the conference was very noticeable. On the other hand, many of the Latin American delegates spoke English fluently. It is well known that the Europeans who do business in Central and South America use Spanish well and understand fully the customs of the countries in which they operate. The Europeans become a part of the social and business life of these countries.

In discussing the situation Mr. Frank A. Vanderlip, president of the National City Bank of New York, pointed out to a representative of the ELECTRICAL WORLD that the lack of men who have a working knowledge of Spanish along with ability in international finance had proved to be one of the chief handicaps to the expansion of his bank in Latin America. When bankers of such training are found few of them are available, chiefly because the opportunities for them here are large and they do not care to be expatriated. Mr. Vanderlip expressed the opinion that the same situation applies to practically all lines of business, and to engineering as well.

A similar opinion has been expressed frequently by Mr. J. G. White. In fact, he has gone so far as to establish prizes at Cornell University and at the Pennsylvania State College for the students most proficient in Spanish. The very wide experience of Mr. White's organization in the Philippines and in Latin America has convinced him of the urgent need of training in Spanish for American engineers. Although the demand for engineers trained in Spanish is certain, adequate means for meeting this demand have been provided in only a very few of the engineering schools in this country. Scarcely any of the engineering educators have acted on this demand, and Spanish courses of practical character for engineering students are provided in only a limited number of institutions.

Gas-Filled Lamp Studies at Boston "Tech"

Investigations of the gas-filled lamp were featured in two theses presented at the graduating exercises of the Massachusetts Institute of Technology, Boston, Mass., this week. The electrolysis of glass used to seal in the leading-in wires of nitrogen lamps was discussed by Mr. Edward C. Walker, 3d, of Boston. The author called attention to difficulties encountered in lamp life when operated on direct current, owing to the cracking of the glass at the point where the wires are sealed into the bulb. As this occurs only in direct-current service, it appeared probable that the breakage might be due to electrolysis taking place through the glass seal. The fact that the seal became hot under ordinary conditions added weight to this hypothesis.

Experiments were made with the exact kind of glass and electrodes used in the construction of commercial lamps. The tests consisted in subjecting the portion of the lamp in question to heating in a horizontal electric furnace the temperature of which could be held constant. The temperatures, up to 1000 deg. C., were determined by a platinum-rhodium couple. The effects of temperature and duration of run were studied and the magnitude of polarization currents was noted. The specimens were examined under the microscope in both ordinary and polarized light to detect any changes. The latter were evident in polarization and transition resistance at 350 deg. C. and were marked clearly at 425 deg. C. Thus, if a run were suddenly interrupted and the electrodes short-circuited through a sensitive galvanometer, the products electrolyzed out of the glass gave rise to a glass battery. The microscope showed that a substance, probably silica, was separated at the anodes, producing distinct cracks in the glass. No corresponding effects took place at the cathodes. It was thus shown that the boro-silicate glass used in the experiments, when heated, conducts electrically.

The effect of frequency on the cyclic variation of candle-power in nitrogen-filled lamps was investigated by Messrs. Leo. B. Miller, Indianola, Ia., and Stephen R. Holmes, Corydon, Ia. Two lamps were used, one operated on direct current and the other on alternating current. Two slotted disks fitted to the same shaft were rotated in front of the lamps, and the admitted light was photometered. The point on the energy wave was determined by a special form of curve tracer. The tests showed nitrogen-filled lamps to be less susceptible to flicker than is the case with any other type of incandescent unit.

Combinations for Foreign Trade

Continuing the series of hearings begun in Boston on June 1 on the subject of combinations for foreign trade, mentioned in last week's issue of the ELECTRICAL WORLD, the Federal Trade Commission held hearings at the Custom House, New York City, on June 3 and 4. Three officials of the Westinghouse Electric & Manufacturing Company, as well as many other business men, gave testimony as to the need of a change in the law to permit combinations of American business interests on foreign-trade matters.

Mr. Edwin M. Herr, president of the Westinghouse company, said that the chief needs are the greatest freedom for conducting trade as it should be conducted; permission for combinations for export business with a protective provision which shall make it certain that foreign competitors shall not get into the combinations so as to affect the business detrimentally; financial arrangements, including not only the establishment of American branch banks such as have already been inaugurated by the National City Bank of New York, but also encouragement of investments in Latin-American securities through the aid of the United States government, and the development of an American merchant marine, insuring cheap carriage of American goods. One of the main causes of development of the business of Germany has been the discriminatory transportation rates given to German shippers by the German steamship lines. Because of lack of satisfactory transportation facilities the Westinghouse company has often sent goods to South America by way of England.

Mr. Calvert Townley, assistant to the president, referred to his recent South American trip, an account of which was given in the ELECTRICAL WORLD of May 1, page 1136. Mr. Townley said that he heard repeated reports that German banks in South America copied invoices of American shipments and gave the information to the German competitors of the American business men. The only way in which this practice can be eliminated is by the establishment of American branch banks to handle American paper. Foreign banks are not anxious to supply United States concerns with information which they give willingly to industries in their own country. Selling combinations should exist similar to those of European manufacturers. Should these be permitted, however, it would be necessary to take steps to prevent European manufacturers from securing admission to the combinations and using the information obtained for the benefit of their own countries.

Mr. Maurice Coster, export manager of the Westinghouse company, said that Russia offers one of the most inviting fields for foreign trade, but that opportunities are curtailed seriously there by the abrogation of the trade treaty. He considers that this treaty was revoked through a misunderstanding. Until such a treaty is re-established American trade with Russia will be hampered seriously.

Mr. John D. Ryan, president of the Anaconda Copper Company and of the Montana Power Company, declared that the United States from the beginning had thrown away its resources in the severest and bitterest competition. This is the greatest economic mistake that this country has made. The United States produces 70 per cent of the copper supply of the world and exports 60 per cent; 50 per cent of the exported copper goes to Germany, which re-exports about one-half of it in manufactured form.

The concerns representing about one-half of the copper produced in this country obtained for their exported product during ten years an average price of 14.38 cents per lb. In the same period domestic buyers paid 15.21 cents per lb. This is entirely the result of combined buying by foreign consumers. The only export trade which this country has which is worth talking about has been built up by the so-called trusts. The economic thought of the country at this time favors combinations for foreign trade.

Massachusetts Electricians' Licensing Bill

A comprehensive licensing bill regulating the installation of electric wiring and apparatus was passed by the Massachusetts Legislature at the session just ended. Under the terms of the act a licensing board composed of the chairman of the civil service commission, the metropolitan fire prevention commissioner, and the commissioner of education is to be established on July 1, and on and after Sept. 1, 1915, no person, firm or corporation except certain classes mentioned below may engage in the installation of electric wires, conduit, apparatus, fixtures or other electric light, heat or motor-service appliances, either as a master or as an employing electrician or as a journeyman electrician, without a certificate from the board.

The board is constituted as the State Examiners of Electricians, and is to employ as clerk a practical electrician who is a wage earner and a citizen of Massachusetts who has had at least ten years' experience in the installation of electric wiring and apparatus. It is to hold frequent examinations in Boston and twice a year in at least five other convenient places within the State, and may hold annual or occasional examinations in other places. Examinations may be in writing or practical work. The master electrician's license is classified as certificate "A" and the journeyman's as certificate "B." Any applicant who has been engaged in the business for at least five years prior to the date of his application is not required to pass an examination, but merely to present proof of fitness.

A drastic provision of the act prohibits the holder of a master's certificate from engaging individually in the actual work of installation. A similar five-years' experience provision also exempts a journeyman from taking an examination. The fee for examination for a master's certificate is $25 and for a journeyman's license $1. An applicant who fails in his examination does not have his fee returned to him, but is entitled to one re-examination free of charge. For each subsequent re-examination he is required to pay $15 on a class "A" application and 50 cents for class "B." Certificates must be renewed annually at the charges of $15 and 50 cents respectively. Certificates are not transferable and may be revoked by the board upon failure of the licensee to comply with the rules and requirements of the business as set forth by the Gas and Electric Light Commission, to which appeal may be taken by the license holder.

Failure to comply with the act subjects the offender to fine or imprisonment, or both. The act does not apply to the installation, repair or wiring of elevators, to the distribution systems of municipal electric plants up to the service switch, to transmission-line construction and maintenance, or to the private work of central stations, electric railways, railroads or signaling companies (including telephone and telegraph concerns); nor does it apply to the work of municipal plants, electric or gas companies in installing, maintaining and repairing, on the premises of customers, service connections, meters and other appliances which remain the property of such plants or companies after installation; nor does it affect street lighting. The penalty provisions do not become operative until sixty days after the organization of the examining board, whose work is to be public, with an annual report to the Legislature of its doings.

DISTRICT-HEATING SERVICE AND SALES

Commercial Possibilities of Central-Station Steam Heating Emphasized at N. D. H. A. Convention at Chicago

With but few exceptions, the papers and committee reports presented at the seventh annual convention of the National District Heating Association at Chicago, June 1, 2 and 3, related to problems of plant operation and maintenance.

The trend of discussion in the convention seemed to indicate, however, that the minds of many members are occupied more with the problems of selling heating service than with methods of operating plants and mains. In seeking to arouse the commercial spirit of the organization to a realization of the possibilities in district heating, one member characterized the industry as the "greatest undeveloped natural monopoly in the world." To prove his point, this member quoted figures to show that the curve of growth of the district-heating business coincides very nearly with the curve of growth of the electric central-station industry in its earlier days.

In registered attendance the convention was the largest the association has held, the registration totaling 258. Members who have attended all of the association's meetings since its inception declared the discussion at this meeting to be more constructive and more enthusiastic than at any preceding meeting.

Why Heating Companies Lose Money

In his presidential address Mr. H. R. Wetherell of Peoria, Ill., said in part: "I believe the day has come when we should not look on steam heating as a by-product of electric service, to be given away at cost or at a loss in order to secure electric business. I believe, with the use of modern heating systems, and with the proper attention and engineering, that steam can be sold by meter rate at a cost which not only will be attractive to customers, but will also pay a good revenue to the heating company."

The coming of the public service commission has also been to the advantage of the district-heating company, continued Mr. Wetherell. Its rulings, which require district-heating companies to sell steam at published rates only, eliminate the old practice of making special rates and giving steam service at low prices in order to secure electric business. Special contracts of this sort are a great many times the cause of the heating department's being operated at a loss.

In closing his paper, Mr. Wetherell recommended establishment of liberal public policy and urged heating companies to assume responsibility or at least to evince interest in that part of the heating system which is on the customers' premises.

Mr. Gilchrist on Utilities as Conservers of Natural Resources

Because the central-heating industry supplies one of the fundamental necessities required by human beings in this latitude, it is an industry of wonderful solidarity, said Mr. John F. Gilchrist, vice-president of the Illinois Maintenance Company and the Commonwealth Edison Company of Chicago. One of the functions of the district-heating industry is to conserve the country's natural resources by effecting a reduction of the total coal consumption. At present, continued the speaker, 517,455,000 tons of coal are annually consumed in this country. Although the electrical industry consumes 44,000,000 tons, or less than 10 per cent of the total coal used, Mr. Gilchrist declared his own belief to be that considerably more than 10 per cent of the work of the country is done by electricity made from coal. The speaker based his opinion on the fact that the coal burned by electrical companies is burned at better than average efficiency, and he predicted that with both electric and steam heating companies consuming coal at such great efficiency, a decrease in the country's total coal consumption might be looked for in spite of its increasing population. As the public becomes educated to the advantages of these two convenient centralized services—electricity supply and district heating—even greater conservation will result.

Speaking of the Illinois Maintenance Company, which furnishes heating service in Chicago, Mr. Gilchrist said that the company was founded primarily to serve as an aid in securing electric motor-service business. Its growth, said he, from several disconnected ganglia of plants and piping, has been steady. While it is still young and undeveloped, its pipe lines have begun to cross streets and alleys, and the production of steam for heating purposes is becoming more and more centralized. Mr. Gilchrist, in closing, urged the practice of selling steam on a profitable metered basis, and declared the regulation of steam-heating utilities by public utility commissions to be beneficial to the heating companies and the heating industry.

Franchise Questions Considered

The report of the public policy committee, of which Mr. D. L. Gaskill of Greenville, Ohio, is chairman, urged education of the public on the subject of the cost and the advantages of heating service. The committee also urged that the cost of making extensions be given publicity and that appraisals be made for rate-making purposes. The committee recommended that the association take a definite stand against the municipal ownership of steam-heating utilities. In the report it was asked that each member of the association give his aid in securing favorable legislation and devote some attention to obtaining adequate franchises.

The matter of franchises was also taken up by the report of the station record committee, of which Mr. A. Biggs of the Edison Illuminating Company of Detroit is chairman. This committee had collected and tabulated data on the provisions contained in the franchises of nineteen steam-heating utilities. This tabulation was presented, together with the committee's comments on the good and bad features of the franchises under consideration.

Standard Practice in Underground Construction

On account of the broad manner in which its subject has previously been treated, the underground construction committee, of which Mr. H. A. Woodworth of Indianapolis is chairman, thought best in this year's report to give the society the benefit of the experience of member companies regarding present-day practice in the selection of materials and in methods of installation and operation of district-heating mains. To obtain up-to-date information for its report, the committee sent out a circular letter containing about twenty questions, of which the following is typical:

"Do you return the water of condensation to the sewer or to the power house?"

Replies to this question indicated that very few plants are returning the condensation water to the power house at present. The replies seem to indicate, however, that this practice will be followed more in the future than in the past. Those operators who are returning the water of condensation to the plant have as a rule found that the installation of the return main is a paying investment.

Besides these questions and the reviews of the answers, the committee's report contained several short articles on heating-utility appraisals and on construction methods.

As one of the greatest advantages of the bleeder-type turbine, Mr. F. W. Laas of the Iowa Railway & Light Company of Cedar Rapids, Ia., cited the fact that such

a unit, in time of sudden peak load or in case of accident in the boiler room, can be operated condensing for a short period. By this procedure the entire electric load can be carried continuously and the steam load can be dropped for the short interval required to restore normal operation.

Interest in Low-Pressure Steam-Cooking Apparatus

The work of the educational committee was so divided among the committeemen that the report contained the following four instructive papers: "The Establishment of a Standard for Transmission Losses from Buildings of All Constructions," by Mr. R. P. Bolton of New York; "Standard Methods of Proportioning Direct Radiation in Standard Sizes of Steam and Return Mains," by Mr. James A. Donnelly of New York; "A Standard Coefficient for Heat Losses Affected by Wind Movement," by Mr. H. W. Whitten of Boston and Mr. R. C. March of Chicago, and "Standard Heating Elements for Cooking Apparatus with Special Reference to Low-Pressure Steam," by Mr. D. S. Boyden of Boston.

Discussion of the committee's report brought out the fact that manufacturers of low-pressure steam cooking apparatus are, in the opinion of the operating men, not keeping pace with the demand for such appliances. Many instances were reported in which the operating men have themselves rebuilt high-pressure steam-cooking apparatus so that it will operate successfully upon low-pressure mains.

Commercial Problems of the Heating Business

The paper of Mr. C. F. Oehlman of the Denver Gas & Electric Company, Denver, Col., entitled "The Commercial End of the Heating Business," outlined the practice of the Denver company in securing heating business and in handling the complaints of its heating customers.

Discussion of this paper showed that operating companies favor the practice of providing plans and specifications for customers' heating installations. It was contended that if the installation on the customers' premises is properly installed, complaints will be reduced to a minimum.

Powdered Coal as a Fuel

In the report of the station-operation committee, of which Mr. Byron T. Gifford of Grand Rapids, Mich., was chairman, the topics of station operating costs, operation accounting, coal costs, and meters and their use were discussed.

Discussion of the report was confined largely to the section on coal. Mr. A. W. Higgins of Indianapolis described the powdered-coal burning installations of the Quigley Furnace & Foundry Company of Springfield, Mass., and of the American Locomotive Company at Schenectady, N. Y. The Merchants' Light & Heat Company of Indianapolis, Ind., has been investigating the possibility of using powdered coal for central-station work, he said, and has shipped Indiana coal to these Eastern plants for test purposes. Although the results of these tests were not disclosed, the tone of Mr. Higgins' remarks indicated that his company is paying considerable attention to the future possibilities of the use of powdered coal.

Exhaust Steam Versus Live Steam for Heating

Tests conducted under the supervision of Mr. C. C. Wilcox of Jackson, Mich., and Mr. G. C. Daniels of Peoria, Ill., on a steam-heating system at Pekin, Ill., were made the basis of a report on the comparative use of exhaust steam and live steam for heating. As the result of these tests, the authors of the paper concluded that the heat consumption for a steam-heating system under similar weather conditions is practically the same for either live-steam or exhaust-steam operation. They concluded further that the weight of steam sent to the heating system is increased as the heat content of the steam is diminished, and that the carrying of an electric load in addition to the heating load cannot be accomplished without an increase in fuel. It was also found that the condensation in mains with live steam is less than that with exhaust steam, and that the pressure drop between the station and the end of the lines is more with exhaust steam than with live steam, owing to the increased send-out when using exhaust steam. Pulsations in pressure caused by the engine exhaust are not propagated, it was said, far from the source.

As part of the discussion of Messrs. Wilcox and Daniels' paper, Mr. George W. Martin of New York City submitted a paper entitled "Exhaust Steam Versus Live Steam for Heating." Others who discussed the paper were Mr. J. G. De Remer of San Francisco and Mr. D. S. Boyden of Boston.

A feature of the routine business session was the passage of a motion allowing the executive committee to establish a quarterly bulletin for the association if, in the judgment of the executive committee, such a bulletin is needed.

The election of officers for the ensuing year resulted as follows: President, Mr. D. S. Boyden of Boston; first vice-president, Mr. B. T. Gifford of Grand Rapids, Mich.; second vice-president, Mr. G. W. Martin of New York City; third vice-president, Mr. W. S. Monroe of Chicago; secretary-treasurer, Mr. D. L. Gaskill of Greenville, Ohio; executive committee, Messrs. C. F. Oehlman of Denver and Thomas Donohue of Lafayette, Ind.

War Orders for Electrical Manufacturers

Many reports of large orders for electrical manufacturing plants for supplies of munitions for the allied armies have been in circulation, and stocks of companies affected have been in demand on the New York market at advancing prices.

A proposition for a large number of portable electric-light plants to be supplied to the allied armies for use in Europe is being considered by two concerns in the Louisville (Ky.) district. Negotiations have not reached a definite conclusion, but reports state that there is every prospect that the deal will be closed on a satisfactory basis. The proposition includes a high-speed gas engine attached to a generating equipment with distributing apparatus, lamps, etc., so assembled that it can be mounted on a wagon and moved readily from place to place.

The New England Westinghouse Company formally took over the business and plant of the J. Stevens Arms & Tool Company, of Chicopee Falls, Mass., and the plants of the Stevens-Duryea Company at Chicopee Falls and East Springfield on June 2. About $2,290,000 is involved in the establishment of the New England branch of the Westinghouse interests in the Springfield district. Mr. L. A. Osborne, senior vice-president of the Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa., headed the group which exercised the options on the properties last week. Operations will be in charge of Mr. Walter L. Clark, formerly vice-president of the Niles-Bement-Pond Company. The immediate business of the company is based upon a large order of rifles for the Russian government. The company has opened an employment office in Chicopee Falls and is urgently seeking machinists competent to handle high-speed production. It is anticipated that an extensive electrical business will be developed by the company in the future, with special reference to supplying the New England and eastern New York trade.

Miscellaneous News Notes

Jovian Outing at Philadelphia.—The Jovian Electrical League of Philadelphia held an outing and field day June 5 at the Observatory Hill athletic grounds of the Philadelphia Electric Company.

Municipal Lighting Proposal Defeated.—A proposed special assessment of $300,000 for building a municipal electric street lighting system at Oak Park, Ill., was rejected on June 7 by the local voters. Energy for street lighting at Oak Park is purchased from the Public Service Company of Northern Illinois.

Present to Massachusetts Institute of Technology.—Messrs. Charles A. Stone and Edwin S. Webster, of Boston, according to an announcement made by President McLaurin of the Massachusetts Institute of Technology at the commencement exercises on June 8, have presented the institute with a house for its president.

Electric Passenger Vehicles for Convention Excursions.—Ladies who were guests at the convention of the National District Heating Association in Chicago, June 1, 2 and 3, were entertained one afternoon by a two-hour ride in electric automobiles through the city's parks. The use of the machines for the occasion was given by local dealers and manufacturers.

St. Louis Officials Inspect Cleveland Municipal Light Plant.—Mayor Henry W. Keil and fifteen aldermen from St. Louis inspected the municipal light plant at Cleveland, Ohio, on June 2. Mayor Newton D. Baker of Cleveland was with the visitors at the plant and took them to inspect other city property. Mr. F. W. Ballard, light and heat commissioner of Cleveland, has spoken in St. Louis on municipal ownership.

Petty Thievery.—Recently the Birmingham (Ala.) Railway, Light & Power Company employed two special detectives to investigate cases where persons were suspected of stealing gas and electricity. As a result fifteen offenders have been convicted. The company now advertises the offer of a reward of $10 for information leading to the conviction of any one stealing gas or electricity. Many responses to this advertisement have been received.

Dayton Company Offers Community Playground.—President F. M. Tait of the Dayton (Ohio) Power & Light Company has tendered to the Civic League of Wilmington, Ohio, where the company furnishes lighting service, the loan of a tract of six and a half acres for use as a children's playground. The company has also offered to lay out baseball, tennis and basketball grounds, and to furnish equipment to complete an up-to-date playground, asking only the cooperation of the local Civic League.

Vehicle-Charging Stations in Philadelphia.—The Philadelphia Electric Company has issued a guide book, with map, giving the location of electric-vehicle charging stations in Philadelphia and surrounding territory. The tabulation includes statements of hours when service can be obtained, maximum current available, rate per kilowatt-hour, and minimum price for charging service. Towns in Pennsylvania, New Jersey and Maryland within touring distance of Philadelphia are also included in the electric-garage list. Several pages of the preface are devoted to Philadelphia street-traffic rules.

Advertising Display at the New York Electrical Show.—One of the features of the 1915 electrical exposition to be held at the Grand Central Palace, New York City, during the coming autumn, will be an electrical advertising exhibit conducted under the auspices of a committee of Eastern central-station representatives. The exhibit will occupy a prominent place near the main entrance of the hall. Mr. Arthur Williams, president of the electrical show company, has invited central-station men to submit samples of their advertising for exhibition to Mr. Cyril Nast, chairman of the committee, Irving Place and Fifteenth Street, New York City.

Settlement of Controversy in Frankfort, Ky.—An agreed judgment representing a compromise of the questions at issue between the city of Frankfort and the Kentucky Public Service Company has been drawn up by counsel representing both sides and will be presented to the City Council for its approval. If accepted, this will end a long controversy between the two parties which resulted in a suit by the company to collect its claim. The agreed judgment scaled the company's claim of $14,000 to $10,500, reduced the maximum rate for energy from 14 to 12 cents per kw-hr., and reduced the yearly charge for street lamps by $2 per lamp.

Mr. Ballard on the Cleveland Plant.—Mr. F. W. Ballard, commissioner of light and heat of the city of Cleveland, was the principal speaker at a meeting of the Toledo Society of Engineers on June 4. Since the municipal plant at Cleveland was put in operation last July, he said, 12,000 customers have been placed on the books, with the plant working at one-third of its aggregate rating. When operated at its full rating he estimated that service could be furnished to 40,000 residents. The annual receipts are $200,000 per year above the cost of operation and maintenance, he said. While the plant is yielding a sufficient amount now to pay bond interest and maintain a sinking fund, Mr. Ballard said he estimated that when operated at its full rating the profits would be $500,000 a year.

Prizes for Central-Station Thrift—Mr. H. F. Frasse, purchasing agent of the Edison Electric Illuminating Company of Brooklyn, N. Y., has offered three graded prizes of $25, $15 and $5 for the best papers contributed by employees of electric-lighting companies on the savings resulting from economical practices and the utilization of waste material. The donor has requested the executive committee of the National Electric Light Association to appoint a committee to pass on the papers submitted. These prizes have been offered, explained Mr. Frasse, as inspiration to careful and conscientious men and to induce greater emulation of those who are already saving money for their employers. In some lines of business bonuses are given salesmen with the view of increasing orders, hence prizes like these, he believes, should act as a stimulus toward economical operation and practice.

World's Biggest Lumber Mill Motor-Driven.—The great new Weyerhaeuser lumber plant near Everett, Wash., has an output of 400,000 ft. of lumber per day, but as a result of the use of electric drive throughout the entire mill will employ only 225 men when in full operation. Motor-driven machines provide for washing the logs and freeing them of stones, convey the raw material to the various saws, stack the finished product preparatory to distributing it to the kilns, and finally load it for shipment. Live rollers and sorting chains, all motor-driven, reduce the number of men required about the new mill. Storage-battery locomotives and trolley locomotives are employed to transfer the tramcars between the sorting table, yard tracks, dry kiln, stacking room and traveling crane. The mill contains 300 motors, ranging from 2 hp to 300 hp in rating. A 3000-hp steam-turbine plant has been installed to generate electricity for the operation of the main plant and of the cedar and hemlock mills to be completed later.

New Sign Ordinance Proposed for Columbus.—Following the Mayor's veto on the first ordinance covering electric signs for Columbus, Ohio, which prohibited all signs from projecting more than 12 in. beyond the building line, a new ordinance was introduced in the City Council and referred to the judiciary committee. Although there are a number of exceptions, the new measure provides that it shall be illegal to erect or maintain within the city any sign, roof, porte-cochère or other structure which projects beyond the building line on any street more than 12 in. Electric signs at a height of between 9 ft. and 29 ft. above the ground and extending not more than 5 ft. 6 in. beyond the building line may be installed upon permit from the building inspector, provided that they are properly constructed, maintained, repaired and illuminated until 10 o'clock at night six days in the week and have at least two lamps of 4 cp for each square foot of surface on each side of the sign. Signs more than 29 ft. above the ground may extend 9 ft. beyond the building line, or if hinged so as to swing in during the day, 14 ft. beyond the building line. Signs erected upward on roofs, not less than 37 ft. above the street, may extend 14 ft. beyond the building line. As no exceptions appear to be made to the requirement that signs should not project more than 13 in. from the building line in the case of other types of signs, the new ordinance, if passed, will free the streets of all overhanging signs except those electrically lighted.

Associations and Societies

Meeting of the A. S. M. E.—The spring meeting of the American Society of Mechanical Engineers will be held at the Hotel Statler, Buffalo, N. Y., from June 22 to 25.

Semi-Annual Meeting of Illinois Contractors.—The semi-annual meeting of the Electrical Contractors' Association of Illinois, to be held at Peoria, is now set for June 25 and 26. The date of this meeting has been postponed one week so that it will not conflict with that of the 500-mile automobile races to be held in Chicago.

Pennsylvania Contractors' Association at Philadelphia.—The fourth annual convention of the Electrical Contractors' Association of the State of Pennsylvania will be held at the Adelphia Hotel, Philadelphia, June 16, at 3.30 p. m. An informal dinner will close the meeting. Mr. M. G. Sellers, 1518 Sansom Street, Philadelphia, is secretary.

Los Angeles Jovians.—Mr. Harrison H. Fogwell presided as chairman of the day at the meeting of the Los Angeles (Cal.) Jovian League, June 2, and Mr. Earl Rogers, attorney, addressed the members. At the luncheon session planned for June 16 Mr. Henry Holland will preside, and there will be addresses by a number of visiting electrical men from the East.

New York Electrical Society.—At the annual meeting of the New York Electrical Society, to be held at the Hotel Martinique on June 15, the following nominations for officers for 1915-16 will be presented: President, Mr. Elmer A. Sperry; vice-presidents, Messrs. S. N. Castle, George W. Elliott and Bernhard Hoffman; secretary, Mr. George H. Guy; treasurer, Mr. Henry J. Hoeltge. After the business session there will be a smoker and entertainment.

Kansas Electrical Contractors' Association.—Mr. I. C. Bushong of Ottawa, Kan., was elected president of the Kansas Electrical Contractors' Association at a meeting held at Topeka on May 22. Mr. J. A. Mercer of Topeka was elected vice-president, Mr. H. S. Lee of the Topeka Edison Company was elected treasurer, and Mr. R. N. Sutton of Wichita was elected secretary. The meeting closed with a banquet at the National Hotel, Topeka. The next session will be held at Kansas City, Mo., July 10.

Rochester Section, A. I. E. E.—Mr. E. L. Wilder was chosen chairman of the Rochester (N. Y.) Section of the American Institute of Electrical Engineers at its annual meeting May 28, and Mr. F. E. Haskell was elected secretary and treasurer. The new executive committee is composed of Messrs. E. F. Davison, Scott Lynn, O. W. Bodier and E. J. Carroll. At the conclusion of the business session Dr. W. R. Whitney, director of the research laboratory of the General Electric Company, gave an illustrated lecture on "Industrial Research."

New York Section, I. E. S.—The last meeting of the New York Section of the Illuminating Engineering Society for the present season will be held at the Brevoort Hotel, Fifth Avenue and Eighth Street, on June 14, when the subject "What the Other Fellow Knows About Lighting Requirements" will be discussed. Mr. Frank E. Wallis, architect, chairman of the fine arts committee, will be the toastmaster. Ten-minute informal addresses will be made concerning the lighting requirements of the architect, mural painter, sculptor, designer and actor.

"Kilowatts" of Dallas Electric Club.—The Dallas (Tex.) Electric Club issues a breezy four-page folder entitled "Kilowatts," which is edited by Mr. Dan Fisher, assistant general manager of the Southern and Texas Traction companies, president of the club and past-president of the Southwestern Electric and Gas Association. At the club's luncheon meeting of June 4 the following fifteen speakers were scheduled, each to speak two minutes: Mr. R. W. Abright, Abright Electric Company; Mr. B. R. Brown, Dallas Consolidated Street Railways; Mr. J. B. Bloomberg, Bell Telephone Company; Mr. Ross Cummings, Western Electric Company; Mr. C. E. Calder, Texas Power & Light Company; Mr. George H. Egan, Egan Electric & Fixture Company; Mr. Lester Gottschall, Buckeye Electric Company; Mr. S. Newton Gaines, Southern Traction Company; Mr. O. T. Hazelton, Western Electric Company; Mr. Fred M. Hoag, Southwest Telephone Company; Mr. C. W. Thompson, Electric Appliance Company; Mr. E. N. Willis, S. W. General Electric Company; Mr. E. M. Powell, Dallas Automatic Telephone Company; Mr. Frank R. Schneider, Dallas Electric Company, and Mr. J. M. England, Cockrell Electric Company. The annual picnic of the Dallas Electric Club will be held on Saturday afternoon, June 19.

Washington E. V. A. Sociability Run.—About eighty electric pleasure vehicles of many different makes and models were entered for the second annual sociability run of the Washington (D. C.) Section of the Electric Vehicle Association in the afternoon of May 27. The route of the run took the contestants through Rock Creek Park and then down Sixteenth Street into Potomac Park and along the river drive to the Point. Twenty solid silver prizes were awarded to the contestants who made the entire run in the time closest to the average time for all the cars. While some drivers made speeds as high as 40 miles an hour, others took a more leisurely fifteen-mile pace. Many of the cars were driven by prominent women. All the machines were decorated with the blue and white pennants of the association. They were sent off at the start on an average of about four to the minute, so that the run appeared to the spectator as one long parade of beautiful cars. At the finish of the run Demonet, a local caterer, served a basket lunch.

Society of Automobile Engineers.—The annual midsummer meeting of the Society of Automobile Engineers will be held on board the steamer *Noronic* during a four-day cruise on Lake Huron, starting from Detroit June 14. Among the papers of electrical interest to be presented before the convention will be those on "A Scientific Method of Testing Electric Vehicles," by Mr. T. H. Schoepf; "Motor Fire Apparatus," by Mr. J. A. Anglada; the report of the electric-vehicle division, by Mr. A. J. Slade, chairman; report of the electrical equipment division, by Mr. A. L. Riker, chairman, and the report of the truck standards division, by Mr. William P. Kennedy, chairman. The electrical equipment division will report on interchangeable bulb bases, sockets and connector plugs for both the grounded-return and insulated-return electrical systems now in use on gasoline automobiles. A revised version of the report of the electrical-vehicle division presented to the society at its January meeting will be considered, attempt being made to standardize motor voltages, motor name-plates, batteries, etc., for use in connection with electric vehicles. Mr. R. McA. Lloyd is chairman of the summer meeting.

Annual Meeting of the S. P. E. E.—The Society for the Promotion of Engineering Education will hold its twenty-third annual meeting at Iowa State College, Ames, Iowa, June 22 to 25, for which the following program has been arranged: On Tuesday morning, June 22, Dr. Raymond Allen Pearson, president of the Iowa State College, will deliver the address of welcome, which will be responded to by Prof. Gardner C. Anthony, a past-president of the society. At the afternoon session Prof. D. C. Jackson will present the report of the joint committee on engineering education, Prof. J. J. Flather the report of the committee on entrance examinations, and Prof. E. V. Huntington that of the committee on teaching mathematics to students of engineering. An address will be delivered by Dr. C. R. Mann of the Carnegie Foundation for the Advancement of Teaching. At Wednesday's sessions two reports will be presented, one by the committee on teaching mechanics to students of engineering and the other by the committee on teaching physics to students of engineering. Prof. A. J. Wood will present the report of the committee on statistics at Thursday's session, Prof. H. E. Webb the report of the committee on secondary schools, Prof. J. T. Faig the report of the committee on standardization of technical nomenclature, and Profs. C. F. Scott, A. M. Greene, Jr., F. W. Sperr and F. P. McKibben the report of the committee on improvements in laboratory instruction. At the afternoon session papers will be read by Dean A. A. Potter, Dean E. D. Walker, Dean P. F. Walker, Director B. W. Benedict, Prof. W. C. Bauer, Mr. A. S. Kinsey, Prof. F. G. Higbee and Mr. A. L. Williston. At the annual dinner Thursday evening, Governor George W. Clarke will deliver an address. At Friday morning's session Chancellor S. B. McCormick will make an address and Director J. F. Hayford will also speak. Dean R. E. Buchanan, Ames, Iowa, is chairman of the general committee.

Public Service Commission News

West Virginia Commission

Governor Hatfield has appointed as members of the commission Messrs. William M. O. Dawson of Charleston, Elliott Northcott of Huntington, and E. F. Morgan of Fairmont. Mr. Dawson is a former governor of the State. Mr. Northcott, the chairman, was United States Minister to Venezuela under President Taft and has served as district attorney for the southern district of West Virginia. Mr. Morgan was formerly judge of the Marion County intermediate court.

Wisconsin Commission

The Legislature has passed an act, originally introduced at the instigation of the commission, requiring every public utility and railroad owning or operating any lines over which energy or messages are transmitted to maintain and operate such lines so as not to interfere unreasonably with the service furnished by another utility because of the proximity of lines. The commission is to have the power to require changes in electric construction or operation whenever required for public safety or to avoid interference.

Massachusetts Commission

The commission has established a maximum price of 12 cents per kw-hr. on the system of the Marlboro Electric Company, upon petition of customers and municipal authorities. The previous rate was based on a demand system of charges in which a primary usage rate of 15 cents was effective according to one schedule and 20 cents according to another, with secondary rates of 12 cents and 6 cents respectively. The company had few demand indicators on its system, the demand usually being estimated at one-third of the customer's connected load, assuming each lamp socket to be the equivalent of 50 watts. In the application of the rate for guaranteed use of the demand the latter was ordinarily determined in each case by observation of the number of lamps in service at any one time. The commission holds that this method of applying the demand system is so crude and liable to abuse as to lack such merit as is ordinarily urged in favor of the system.

The city practically conceded that the cost of the property necessary or desirable for the company's business is a controlling factor in determining the rate, but it also claimed that no allowance should be made for property which has been superseded by a permanent arrangement for the purchase of energy from outside sources, on the ground that had there been a wise administration of the company's affairs these losses would have been anticipated and provided for.

In the entire absence of evidence of mismanagement or dishonesty, the board believes that under the long-established policy of the State all the paid-up capital honestly and prudently invested should be recognized under normal conditions in the determination of a fair rate, but points out that it does not follow that idle capital is to be on the same footing as active capital. The board distrusts a valuation as a decisive test of investment where actual cost of the property and the circumstances under which it was acquired can be ascertained. It is also of the opinion that one of the important functions of depreciation, besides care of the daily wear and tear, is the anticipation of changes in the art and in the possible intervening conditions, which, although they may have little or no relation to the useful life of the physical property, cannot be foreseen ordinarily. It realizes that a prudent management cannot always have provided fully for changes of this character, and especially in the first stages of the industry, or in a case like this where the business of the earlier years was not profitable. It believes that a proposition to allow the right of the investment to a return, but to disallow in any substantial measure the right to keep it good, is not sound or consistent. In view of the need of a more adequate provision for depreciation, the commission did not reduce the price to the 10-cent level advised by the city's engineering witness.

The board believes that interruptions of the service are likely to be less frequent in view of the improved operating conditions now enjoyed by the Connecticut River Transmission Company, which supplies energy to the Marlboro company, and the sources of trouble from the overloading of circuits are local and have been remedied. Some general criticisms were directed at the company for extending its lines unduly into territory where the business is of a character to show little or no profit. So far as the board is aware, however, such extensions have been made only in response to actual needs or in reasonable anticipation of such needs. The commission holds itself reluctant to say anything to discourage the supply of energy to all in the territory covered who can be reached properly by the company's lines. During the last six years the output has increased about 300 per cent, and there is reason to believe that by no means has it reached its probable extent even with the present investment. If this prediction is correct, the 12-cent rate can be bettered later.

Ohio Commission

A tentative valuation of the physical property of the electrical system of the Union Gas & Electric Company of Cincinnati, Ohio, for rate-making purposes was fixed at $8,451,580 by the commission, according to an announcement made on June 3. The valuation fixed by the company, including physical and intangible elements, as stated in the ELECTRICAL WORLD of May 15, 1915, is $21,049,681. The commission made no allowance in its valuation as issued for franchises, while the company holds that $5,581,600 should be included for this item. The cost of financing, placed at $2,550,263, was also omitted in the commission's valuation. All the values are lower than those made by the company's appraisers. The matter is now ready for hearings on the points of difference, and the company may bring proof to show wherein the commission's figures should be changed. The summary of the commission figures follows:

	New Cost	Amount of Depreciation	Present Value
Land	$473,543	.....	$473,543
Buildings	1,160,094	$196,763	963,331
Power plant equipment	2,278,639	451,404	1,827,235
Substation equipment	797,192	110,751	686,441
Distribution system — underground—not including services and street lighting	1,667,842	200,747	1,467,095
Distribution system — underground—services and street lighting	121,129	24,422	96,707
Distribution system—overhead —not including services and street lighting	1,170,376	208,455	961,921
Distribution system—overhead —services, meters, and street lighting	443,079	142,650	300,429
Distribution system — water-testing department, Fourth and Plum Streets	12,242	2,371	9,871
General—furniture and fixtures, transportation equipment and tools	55,008	14,917	40,091
General stock	229,563	55,628	173,935
	$8,408,707	$1,408,108	$7,000,599
Interest during construction—one and one-half years at 6 per cent to 9 per cent	756,784	126,730	630,054
Taxes during construction—one and one-half years at 1½ per cent to 2¼ per cent	189,196	31,682	157,514
Preliminary organization and franchise expense	241,305	.....	241,305
"Cost of attaching business"	312,000	.....	312,000
Working capital	110,108	.....	110,108
Total	$10,018,100	$1,566,520	$8,451,580
Not used and useful—inside city	140,522	30,217	110,305
Used and useful—outside city	191,469	34,813	156,656
Grand total	$10,350,091	$1,631,550	$8,718,541

President W. W. Freeman of the Union company, when informed of the finding, said that the figures are merely tentative and that they will be taken up in detail with the commission as soon as they have been checked by the company's engineers. In that way it can be found where the variations lie and both the company and the city will be permitted to show wherein errors of omission and undervaluation have been made.

Mr. Freeman also pointed out that the King valuation, made at the request of the City Council a year ago, is shown by the finding which was made by the commission to have been inadequate.

City Solicitor Schoenle of Cincinnati said that he could not discuss the findings of the commission until he had given them a thorough study, but he thought that the City Council now has the basis for rate-making and should act by July 1, when the present temporary contract expires.

Pennsylvania Commission

The commission has issued an order restraining the Big Spring Electric Company of Newville from putting into effect the proposed schedule providing for an increase in rates for energy for motor service. Manufacturers declared that the proposed rates were greatly in excess of charges of other companies for the same service.

Indiana Commission

The commission has received recently an unusually large number of applications to surrender franchises and accept indeterminate permits from lighting companies. In each case the utilities believed that it would be to their advantage to accept the full protection of State regulation, though some of them waited until local conditions, such as new competition, forced them to action. Among the companies whose applications have been approved by the commission is the Syracuse Power & Light Company. The Montpelier Utilities Company has surrendered a franchise granted by the city of Montpelier.

The commission has granted authority to the Indiana Utilities Company to purchase the electric plant at Ashley, Ind. The principal office of the company is at Angola, Ind. The Ashley plant has been operated by the municipality. The purchase price is $2,100. A recent fire damaged the city's utility to such an extent that proper operation was not possible. The company then offered to purchase the plant, including the property damaged by the fire.

Missouri Commission

In its annual report for the last year the commission says in part:

"A proper consideration of the element of depreciation in fixed assets will preserve integrity of the capital invested, as well as the operating accounts, provide for eventual replacement of worn-out property, prevent the marketing of securities of run-down plants, and positively prevent the payment in dividends of that portion of the plant that has been consumed during the year.

"A number of the rate schedules are quite complicated, and this is particularly true of electric schedules. A number of revisions have been received which, if allowed to become effective as filed, would have resulted in discrimination among consumers technically of the same class in violation of the law. The probabilities of such discrimination are usually called to the attention of the utility, and, if pertinent, suggestions are made for a revision or addition without illegal discrimination. The advice of this department in such matters is almost invariably accepted.

"The establishment of service rules will add considerably to routine duties and will involve an addition to the present working force and more or less elaborate laboratory and field equipment. Co-operation with the State University in these matters has been seriously considered, as the university laboratories are already well equipped for work of this nature and its faculty has expressed a willingness to co-operate with the commission. However, it would be advisable for the commission to be supplied with a suitable equipment of its own for ordinary referee and standardization testing.

"The standards promulgated by the committee on overhead-line construction of the National Electric Light Association have been advocated as a guidance for construction work pending the adoption of general rules and regulations on this subject by the commission.

"The commission has endeavored in every way possible to improve conditions among employees of public utilities by letting it be known that adequate service as considered by the commission always contemplates reasonably courteous treatment to the public. Such employees can make for the company one of its most valuable assets by fair and courteous treatment—the good will of the public. In some hearings citizens have been more than anxious to testify in behalf of the courteous and accommodating disposition and kind treatment of the local railroad agent or the superintendent or manager of another local utility.

"The commission recommends provision in the law for the 'indeterminate permit,' similar to the one in Wisconsin. It recommends the submission of a constitutional amendment providing that all appeals from orders and decisions of the commission shall go directly to the Supreme Court."

Personal

Mr. C. D. Ingersoll has been appointed treasurer and manager of the Lewiston (Ill.) Electric Company as successor to Mr. C. W. King.

Mr. R. Schaddelee has been elected president of the People's Gas & Electric Company of Mason City (Ia.), succeeding Mr. W. E. Brice.

Mr. W. M. Brooks has succeeded Mr. D. MacRostie as superintendent of the Lone Pine Division of the Southern Sierras Power Company.

Mr. B. H. Burns has been elected president and treasurer of the Caney (Kan.) Electric Light & Railway Company, succeeding Mr. B. S. Ayres.

Mr. H. H. Adams has been appointed engineer of the Stockton (Cal.) plant of the Oro Electric Corporation, as successor to Mr. H. S. Ainsworth.

Mr. F. M. Stone has been appointed superintendent at Morrisonville, Ill., for the Southern Illinois Light & Power Company, succeeding Mr. H. E. Hough.

Mr. R. A. Joslyn, of the electrical engineering department of the Edison Electric Illuminating Company of Boston, has resigned his position with the company.

Mr. Charles P. Taft, a brother of former President William Howard Taft, has been appointed a director of the Union Gas & Electric Company of Cincinnati, Ohio.

Mr. Fred Unger, former manager of the Chicopee (Mass.) municipal lighting plant, has accepted an executive position with the Remington Arms Company of Bridgeport, Conn.

Mr. John Joseph Carty, president-elect of the American Institute of Electrical Engineers and chief engineer of the American Telephone & Telegraph Company, was given the honorary degree of doctor of engineering by Stevens Institute of Technology on June 8.

Mr. J. W. Hughes has been appointed electrical engineer of the Eastern lines of the Canadian Pacific Railway, succeeding Mr. J. A. Shaw, who, as announced in these columns, was recently appointed electrical engineer of the entire Canadian Pacific system. Mr. Hughes was formerly assistant to Mr. Shaw, and before entering the railroad's service was a member of the staff of the Montreal Light, Heat & Power Company.

Mr. David S. Boyden, the newly elected president of the National District Heating Association, is superintendent of the steam-heating-service department of the Edison Electric Illuminating Company of Boston. Mr. Boyden was born at Walpole, Mass., Dec. 28, 1872, and after completing his public-school education in Walpole and Boston he entered the electric-lighting industry in 1895 as an employee of the Suburban Light, Heat & Power Company of Boston. Later he held a position with the Walworth Light, Heat & Power Company, another Boston concern, which supplied steam heating and electric lighting. At a subsequent date as manager of the Block Plant Electric Light Company and the Ayer Electric Light Company, Mr. Boyden divided his time between Boston and Ayer, Mass. Resigning this dual position, he became connected with the Templeton (Mass.) Street Railway Company, with which concern he remained until in 1908, when he was made superintendent of the steam-heating-service department of the Edison Electric Illuminating Company of Boston. For the last four years, however, Mr. Boyden has been carrying the duties of assistant superintendent of the electrical-engineering department of the Boston Edison Company in addition to those of superintendent of the heating department. Mr. Boyden is a member of the American Society of Heating & Ventilating Engineers, the American Institute of Electrical Engineers, the National Electric Light Association and other technical societies.

D. S. BOYDEN

Mr. C. J. Lipp has been appointed secretary-treasurer of the Jamestown (N. Y.) Lighting & Power Company to fill the vacancy caused by the recent resignation of Mr. Albert S. Price.

Mr. Charles J. Esterly has resigned as sales manager of the Metropolitan Electric Company of Reading, Pa., and has accepted a similar position with the American Die & Tool Company of the same city.

Mr. D. B. McIntyre, superintendent of construction and maintenance for the Montreal (Que.) electrical commission, has resigned after two years in the commission's service to accept a position in New York.

Mr. George N. Cox, formerly assistant superintendent of the Taunton (Mass.) Electric Light Company, has been elected secretary and a director of the newly organized New England Westinghouse Company, with headquarters in Boston.

Prof. Robert L. Sackett, formerly of the civil engineering school of Purdue University, Lafayette, Ind., has been appointed dean of the engineering school of Pennsylvania State College. Professor Sackett succeeds Prof. John Price Jackson, who is now commissioner of labor for the State of Pennsylvania.

Mr. Fred H. Libby, who has been connected with the Bangor (Maine) Railway & Electric Company for many years in various capacities, has been appointed to succeed the late Walter L. Sawtelle as manager of the lighting and power department of the company. Mr. Libby has recently acted as assistant to Mr. Sawtelle.

Mr. F. C. Pullen, formerly new-business manager for the East St. Louis (Ill.) Light & Power Company, has been appointed sales manager for C. J. & F. E. Briner, electrical engineers and contractors, St. Louis, Mo. During the fifteen years in which Mr. Pullen has been engaged in the electrical business he has been employed by the Western Electric Company at Chicago, Kohler Brothers of Chicago, the General Electric Company at St. Louis, and at three plants of the Hodenpyl-Hardy Company and the E. W. Clark Management Corporation.

Mr. D. H. Braymer, who has joined the staff of the ELECTRICAL WORLD as associate editor, has for the last five years been editor of *Electrical Engineering* of Atlanta, Ga., and of its predecessor, the *Southern Electrician*. Mr. Braymer, who was born at Hebron, N. Y., in 1884, was graduated in 1906 from the six-year course at Cornell University with the degrees of A.B. and E.E. After graduation he engaged in special work on alternating-current apparatus for the Electrical Testing Laboratories, New York City, resigning to become factory inspector for the Western Electric Company at New York. Later he was appointed special engineer for that company, and in 1910 he went to Atlanta to become editor of the *Southern Electrician*.

Obituary

James Malia, who for thirty years had been chief electrician for Armour & Company, Chicago, died in that city on May 27 at the age of fifty-four years. Mr. Malia was well known in Chicago electrical circles.

Herbert H. Barnes, until recently owner of the electric-lighting plant at White River Junction, Vt., died at Dover, Mass., on June 5, after a prolonged illness. He was proprietor of the Hotel Brunswick, Boston, Mass., and was sixty-one years of age.

E. M. Reed, one of the pioneers in the electrical industry in the West, died June 1, of tuberculosis, at Lancaster, Wis. Mr. Reed was for years in business for himself, and at one period represented the Monarch Electric Company. He was at different times superintendent of electrical plants at Pueblo, Col., Wichita, Kan., and elsewhere, and he superintended the electrical work during reconstruction at Fort Leavenworth. About seven years ago he became Kansas City representative of the Wagner Electric Manufacturing Company, and he continued in local sales work for the company following the establishment of the latter's branch office at Kansas City.

Corporate and Financial

Chattanooga (Tenn.) Railway & Light Company.—The results of the company's operations for the years 1909 and 1914 are as follows:

	1909	1914
Gross earnings	$769,159	$1,085,096
Operating expenses	444,850	616,966
Net earnings	$324,309	$468,130
Taxes	61,201	82,758
Net earnings after taxes	$263,108	$385,372
Interest	198,725	339,408
Surplus	$64,383	$45,964
Energy sold to lighting and motor-service customers, kilowatt-hours	3,036,268	12,567,439
Total connected load in kilowatts	5,088	18,891
Lighting and motor-service customers	3,584	8,730

Columbia Gas & Electric Company, Huntington, W. Va.—According to the annual report for 1914 the company has made progress during the year. The operation of the generating and distributing system of the electric department has continued without interruption and the property has been maintained adequately. During the year 79 miles of overhead and underground lines were constructed, and 1678 services and 1486 meters were installed. On Dec. 31 there were 21,742 electric customers, an increase over 1913 of 1416, or 7 per cent. The power house has been connected with the power house of the Kentucky companies, thereby simplifying and improving operating conditions and further guaranteeing the continuity of energy supply to both companies. These advantages, together with the reduced cost of production, fully justify the outlay incurred. Plans for the erection of a new generating station have been completed, and material progress in arranging for the financing of this undertaking has been made. In presenting the report, Mr. A. B. Leach, the president, pointed out that the growth in electric business was retarded seriously by the electric rate investigation which continued throughout practically the entire year. The continued discussion of this matter in the public press and otherwise has served to disturb the minds of prospective consumers and to postpone any aggressive commercial program. With an early settlement of this question and the completion of the plan for financing the new generating plant, which will provide necessary additional capacity, the company will be able to prosecute a vigorous campaign for new business. The consolidated income statement of the Columbia Gas & Electric Company and the Union Gas & Electric Company for the year ended Dec. 31, 1914, follows:

	1914	1913
Income:		
Gross earnings	$5,851,537	$5,497,959
Operating expenses and taxes	2,678,017	2,574,644
Net earnings	$3,173,520	$2,923,315
Other income	470,864	471,584
Total gross income	$3,644,384	$3,394,899
Deductions:		
Accrued rentals to Cincinnati Gas & Electric Company	$1,788,552	$1,788,250
Accrued rentals to Cincinnati Gas Transmission Company (including sinking-fund requirement of $250,000)	708,305	718,208
Accrued interest of the Union Gas & Electric Company	80,949	79,172
Surplus earnings of the United Gas & Electric Company apportionable to its outstanding stock	586	325
Total deductions	$2,578,392	$2,585,955
Net income	$1,065,992	$808,944
Fixed charges—Columbia Gas & Electric Company:		
Accrued interest on first mortgage gold bonds of Columbia Gas & Electric Co.	$516,240	$499,225
Accrued interest on 5 per cent gold debentures of Columbia Gas & Electric Co.	123,262	61,600
Other accrued interest of Columbia Gas & Electric Company	35,452	28,998
Total fixed charges	$674,954	$589,823
Surplus	$391,038	$219,121
Sinking fund payments—Columbia Gas & Electric Company	$95,005	$95,005

*Only six months' interest, debentures having been issued as of July 1, 1913.

Consolidated Electric Company, San Francisco, Cal.—The California Railroad Commission has rendered a decision upon the application for a modification of its previous order

whereby it authorized the acquisition of the United Light & Power Company by the Great Western Power Company through the medium of a new corporation known as the Consolidated Electric Company. The original order provided that the $471,000 bonds of the Consolidated company to be purchased by the Great Western company should be held in a special sinking fund. The modified order provides that these bonds may be held by the trustee under the mortgage of the Great Western company until their sale shall be approved by the commission. The original order also provided for a 1 per cent sinking fund on the Consolidated company bonds. The modified order gives the companies the option of continuing this sinking fund or of providing that the guarantee of the bonds by the Great Western company shall be in such form that in case of default in interest or principal the Consolidated company bondholders should have recourse to the Great Western company properties, subject to existing liens or liens hereafter to be placed on the Great Western company properties. The Consolidated company applied for authority to issue $2,593,000 bonds. The applicants estimated the present value of the properties to be acquired from the United company and held by the Consolidated company at $1,972,000. The order stated that the sinking fund was for the purpose of restoring the normal relationship between the value of the properties and the outstanding bonds.

Detroit (Mich.) Edison Company.—At the special meeting of stockholders the plan for the authorization of a mortgage as security for an issue of $75,000,000 twenty-five-year bonds was ratified. It is proposed to issue $3,500,000 at once and arrangements have been made with a syndicate of bankers for the sale of this amount. The purpose is to provide funds to reimburse the company for outlays already made for improvements, betterments, etc., as well as to strengthen the working balance. A substantial amount was expended last year, but the treasury has not been reimbursed fully for the outlay. The rate of interest on the initial issue has been placed at 5 per cent. As soon as necessary details have been completed it is expected that the bankers will make a public offering of the bonds at a price around par.

Nevada-California Power Company, Denver, Col.—The following earnings statement for the year ended Dec. 31, 1914, has been filed with the California Railroad Commission:

Operating revenue		$960,431
Operating expenses		515,897
Net operating revenue		$444,534
Non-operating revenue		71,091
Gross corporate income		$515,625
Deductions, non-operating:		
Interest	$195,580	
Miscellaneous	81	
		195,661
Surplus for year 1914		$319,964
Balance Dec. 31, 1913		1,451,263
Total		$1,771,227
Deductions for year:		
Dividends	$200,000	
Sinking-fund appropriations	63,380	
Other appropriations	3,063	
		266,443
Surplus Dec. 31, 1914		$1,504,784

Pacific Gas & Electric Company, San Francisco, Cal.—The California Railroad Commission has authorized the company to issue 19,226 shares of common capital stock.

Salem (Mass.) Electric Light Company.—The company has petitioned the Massachusetts Board of Gas and Electric Light Commissioners for authority to issue $400,000 additional stock. It is proposed to sell the stock, which has a par value of $50 per share, at $65 per share. The proceeds will be used to cancel floating debt and for new extensions. Since June 30, 1911, $607,118 has been expended in the extension of plant, and new additions are being made now. The net debt is about $109,000, and the cost of the work to be done will be about $411,000.

Tennessee Power Company, Chattanooga, Tenn.—The annual report of the company states that the deficit shown for 1914 was due principally to the excessive drought which continued throughout the year until the first of December, requiring the generation of a much larger amount of energy by steam than during years of normal rainfall. The statement of earnings for the year is as follows:

Gross earnnigs		$700,372
Operating expenses		330,391
Net earnings		$369,981
Taxes		25,718
Net earnings after taxes		$344,263
Interest charges	$376,756	
Rentals	105,833	
Total fixed charges	$482,589	
Less contribution toward interest charges as explained in letter of May 29, 1914, to the stockholders of Tennessee Railway, Light & Power Company	100,000	382,589
Deficit		$38,326

Tennessee Railway, Light & Power Company, Chattanooga, Tenn.—The annual report of the company for the year ended Dec. 31, 1914, being the first annual statement to the stockholders, shows the results of the combined operations from the beginning of the organization, May 1, 1912, to Dec. 31, 1914, during which time the gross earnings for the company amounted to $10,202,245 and net earnings to $4,848,250. The balance after the payment of dividends was $1,654,863, while a balance was left for renewals, depreciation and financial requirements, after the dividends had been paid, of $192,203. In submitting the report, Mr. C. M. Clark, the president, states that the two principal causes for the unsatisfactory showing for the year 1914 were: First, the depression in business, which particularly affected industrial centers like Nashville and Chattanooga and resulted in economy in the use of electric light and power and street-railway service. The European war increased this depression, and its bad effect on financial and industrial conditions prevented the closing of several large industrial contracts. Second, in 1914, the worst drought was experienced in Tennessee since 1904 (the previous record low-rainfall year). This reduced the amount of hydroelectric power available for sale and forced the company to operate its steam plants to a much larger extent than ordinarily necessary, thereby greatly increasing operating expenses. This drought was broken in December, and since then there has been an excess of water-power. The prospects for 1915 indicate an improvement in every way, and the results should be better than in 1914. Very little will be required for capital expenditures during the year, except such as may be necessary for extensions of transmission lines to secure additional business. With the return of normal business conditions the management feels that there will be a very decided increase in the earnings of all the controlled companies. The combined statement of operations of the company and its constituent companies, eliminating inter-company business, for the year is as follows:

Gross earnings		$3,762,387
Operating expenses and rentals		1,959,183
Net earnings		$1,803,204
Taxes		311,806
Net earnings after taxes		$1,491,398
Interest, etc.		1,094,420
Balance		$396,978
Dividends paid on stocks of constituent companies not owned		109,049
*Balance		$287,929

*Of this balance $1,628.61 accrues to stock of constituent companies not owned by Tennessee Railway, Light & Power Company.

Utah Securities Corporation, Salt Lake City, Utah.—The corporation, which controls the Utah Power & Light Company and the Utah Light & Traction Company, has issued a pamphlet report. The corporation was incorporated in September, 1912, and acquired control of numerous properties in Utah, Idaho and Colorado, many of which have now been interconnected by high-tension transmission lines. President Sidney Z. Mitchell states that during the last two years the company's management has been largely occupied in acquiring additional properties, retiring underlying securities, clearing titles, rearranging rates and readjusting franchise conditions. The construction period for the immediate future and the work of readjustment and reorganization is practically completed, and as a result the company finds itself for the first time in position to proceed along ordinary operating lines. Mr. Mitchell expects from now on an improvement in operating results. Earnings were affected by the depressed condition of the copper and

other mining industries in the territory served, occasioned by the European war. These industries are now resuming operations along normal lines, and an improvement in business conditions and power output is expected. The combined net income account of the corporation and its subsidiary, the Utah Power & Light Company, including the subsidiaries of the latter, for the year ended March 31, 1915, is as printed below:

Gross earnings (interest and dividends)		$696,068
Expenses		30,287
Net earnings		$665,781
Surplus of subsidiary companies accruing to Utah Securities Corporation:		
Utah Power & Light Company, net divisible income	$398,408	
Less dividends paid to Utah Securities corporation	366,740	
Balance	$31,668	
Utah Light & Traction Company for the six months ended March 31, 1915 (period of ownership), net divisible income	43,562	
		75,230
Net earnings		$741,011
Profit on redemption of ten-year 6 per cent gold notes	$1,352,522	
Less commission paid on underwriting	42,865	
Balance		1,309,657
Income from all sources		$2,050,668
Deduct interest charges on ten-year 6 per cent gold notes		1,063,009
Combined net income		$987,659

Manufacturing and Industrial

The W. G. Speilman Electric Company, Butler, Pa., has taken over the business of the Speilman & Baker Electric Company of Butler.

W. N. Matthews & Brother, St. Louis, Mo., have opened an office in Salt Lake City, Utah, which is in charge of Mr. F. C. Morton, who will report to Mr. O. H. Davidson of their Denver office.

The Edmund T. Perkins Engineering Company of Chicago announces the opening of a branch office in the Illinois State Bank Building at Quincy, Ill., under the supervision of Mr. A. H. Beitmann.

C. J. & F. E. Briner, electrical engineers and contractors of St. Louis, Mo., have erected a three-story reinforced-concrete building. The business of this concern is being expanded and new departments are being added.

The Butler-Edwards Electric Company, Easton, Pa., has appointed Mr. W. E. Butler president of the company, succeeding Mr. Neilson Edwards. The latter is now vice-president of the Nitrogenous Chemical Company of Philadelphia, Pa.

The Morgan Electric Company, Detroit, Mich., which has recently been organized, is planning to build a factory to manufacture the Rae electric starter for automobiles. The starter was designed by Mr. Frank B. Rae. Mr. C. L. Morgan is president of the company.

The International Battery Company, 173 Lafayette Street, New York, which was recently formed, is manufacturing various types of electrical novelties and flashlamp batteries. Mr. S. Fassy is president of the company, Mr. V. Grazi treasurer, and Mr. J. Tiscione secretary.

George H. Wahn Company.—Mr. George H. Wahn has resigned as sales manager of the Stuart-Howland Company, Boston, Mass., and has established an electrical jobbing and supply business at 54 High Street, Boston, under the firm name of the George H. Wahn Company.

Westinghouse Motor for Large Blower.—The blower for cooling air-blast transformers in the Blue Island station of the Public Service Company of Northern Illinois, Chicago, Ill., which was described on page 1208 in the ELECTRICAL WORLD of May 8, is operated by a 30-hp Westinghouse motor.

The Gas Engine & Electric Company, 174 King Street, Charleston, S. C., has recently been organized and is specializing in lighting apparatus for boats, automobiles and farms. Mr. H. Stevens White is president of the company, Mr. J. F. Riddle vice-president, and Mr. A. D. Wall secretary and treasurer.

Larger Quarters for the John A. Daum Company.—Increased business has caused the John A. Daum Company of Pittsburgh, Pa., to seek larger quarters, and it has leased the first floor of the Martin Building, 119 Federal Street, Pittsburgh. The company deals in electric wiring and lighting fixtures.

The McIntosh & Seymour Corporation, Auburn, N. Y., has appointed Mr. V. E. Raggio, 1107 Nevada Street, El Paso, Tex., as its representative in Arizona, New Mexico, territory in Texas west of a line drawn north and south through Del Rio, and the States of Sinaloa, Sonora, Chihuahua and Durango in Mexico.

Storage Batteries for Submarines.—A contract for making storage-battery cells for the United States submarine E-2 has resulted, it is reported, in a big increase in activity at the Edison Storage Battery Company's plant, Orange, N. J. The company is also building storage batteries for the submarine L-8, which will soon be launched.

The Fort Wayne (Ind.) Engineering & Manufacturing Company has established an office in Chicago at 343 South Dearborn Street with Mr. Neil McIntosh in charge. This office will be the headquarters of the company for sales made in territory in Illinois, Wisconsin, Minnesota and Iowa. The company has also moved its Boston office from 141 Milk Street to 123 Olive Street.

Underwriters Approve Electric Bells.—The "Marlo" bells, ranging in size from 5 in. to 12 in., made by the P R Manufacturing Company, 621 Bellevue Avenue, Detroit, Mich., have recently been approved by the National Board of Fire Underwriters. The approval includes bells for batteries and for 110-volt alternating-current and direct-current lighting circuits and also transformer bells for schools and factories.

The Standard Electric Company, Minneapolis, Minn., has been formed by Messrs. Fred G. Dustin and Charles W. Errick to engage in electrical contracting work. Mr. Dustin was formerly chief electrical inspector for the city of Minneapolis and afterward became manager of the Northern Electrical Company of Minneapolis. Mr. Dustin is a past-president of the Western Association of Electrical Inspectors and also past-president of the Minneapolis Electric Club.

Electric-Automobile Sociability Run.—The Waverley Company, Indianapolis, Ind., has inaugurated a series of monthly trips or sociability runs, as they are called, of electric pleasure cars in the neighborhood of Indianapolis. The object of these trips is to convince the public that electric vehicles are well adapted for tours of considerable length on country roads. Recently, in a trip of this kind, ten Waverley cars were driven by their owners to Mooresville, 20 miles from Indianapolis, and return.

New Glassware for Showrooms.—The Gleason-Tiebout Glass Company, 71 West Twenty-third Street, New York, has recently developed a new transmitting glassware material for artificial lighting units in showrooms where daylight conditions are desired. In the development of this product the Gleason-Tiebout company has received the assistance of James G. Johnson & Company, New York, wholesale milliners and experts in color values, whose cooperation was primarily given for the purpose of obtaining suitable fixtures for its new showrooms. One hundred and sixty units have been ordered for the illumination of these rooms.

Orders for Oil Engines.—August Mietz, 128 Mott Street, New York, manufacturer of Mietz & Weiss oil and gas engines, has recently received the following orders for oil engines: Two 50-hp oil engines for the Grinden Art Metal Company, Brooklyn, N. Y.; one 50-hp and one 75-hp oil engine to operate an alternator in connection with an electric-lighting plant for the town of Schleswig, Ia.; one 25-hp oil engine for the Belle Ellen Stock Farms, Branchville, N. Y.; one 30-hp oil engine for I. H. Pitts & Son, Waverly Hall, Ga.; one 25-hp oil engine for Marcus Mason & Company, South Framingham, Mass.; one 35-hp oil engine for Mr. C. N. Taylor, Salisbury, Mass.; one 40-hp oil engine for Mr. George Buckley, Menlo, Ia.; two 200-hp oil engines and four 50-hp oil engines for lightships No. 101 and No. 102 of the United States government.

Consolidation of Electric-Vehicle Companies.—The Baker Motor Vehicle Company and the Rauch & Lang Carriage Company, both of Cleveland, Ohio, have been merged. The combined companies will have a capital stock of $2,500,000, of which $1,750,000 will be common stock and $750,000 7 per cent cumulative preferred stock. The plans provide that Mr. C. L. F. Weiber, president of the Rauch & Lang Carriage Company, will be president of the new company. Mr. Fred R. White, of the Baker Motor Vehicle Company, will become first vice-president; Mr. C. J. Lang, of the Rauch & Lang Carriage Company, second vice-president; Mr. R. C. Morton, treasurer; Mr. George H. Kelly, secretary, and Mr. F. W. Treadway, counsel.

Electric Ranges by the Carload to Missouri.—What is said to be the first carload lot of electric ranges ever consigned to a point in Missouri was recently shipped from the factory of the Hughes Electric Heating Company of Chicago to the Missouri Public Utilities Company at Poplar Bluff, Mo. This central-station company, which is one of the subsidiaries of the Light & Development Company of St. Louis, has established a 3-cent cooking rate, and Mr. F. M. Wilkes, local manager of the Poplar Bluff property, has taken advantage of this low charge to place ranges in many homes in his city. About eighty-five ranges have been sold and installed up to the present time. Of this number thirty-eight were sold in the month of May. According to Mr. Wilkes, hot days are the best days on which to sell electric ranges.

Outlook for Electric Vehicles in Norway.—Mr. Haakon E. Dahr, Jr., United States vice-consul stationed at Christiania, Norway, reports that in a recent address Mr. Arthur Bjerke, a Swedish electrical engineer, declared that in spite of the many hills in Norway electric cars are practicable, citing England and America as countries where such vehicles are being employed in districts just as hilly as those in Scandinavia. Mr. Bjerke referred to an American storage battery as being both the strongest and the one most used. Mr. Dahr states that most of the private automobiles and all the touring cars in Norway are run only in the summer, a time when the central stations have more power available than in the winter. Electric power plants are not far apart in Norway, and therefore it is possible for a car to travel practically all over Norway and be recharged whenever necessary.

Western Electric Officials Report on Foreign Conditions.—Some seventy officials and salesmen of the Western Electric Company recently met at luncheon in the Martinique Hotel, New York, and heard four of their number talk on foreign conditions. Mr. Gerard Swope, vice-president and general sales manager, who has just returned from a six weeks' trip to Europe, spoke of business in the warring countries. Mr. S. M. Stiller, who has been in China three years, told about the increasing use of the telephone in that country. Mr. H. C. Mitchell, representative of the company in Buenos Aires, gave some information regarding installations of the company's products in Argentina, and Mr. M. Matsushiro, manager of the branch office of the Japanese Western Electric Company at Osaka, reported on conditions in Japan. Among the officials of the company present were Messrs. H. A. Halligan, vice-president, C. E. Scribner, chief engineer, J. W. Johnston, treasurer, and R. H. Gregory, controller.

Opportunity for American Gas-Filled Lamps in the Argentine.—Mr. J. P. Stone, who recently returned from South America, reports that in the Argentine Republic, where gas-filled incandescent lamps are now being largely used, he did not see any lamps of American manufacture. The market there is supplied chiefly with lamps of several European makes, among which are the Philips, Osram and Tungsram brands. Lamps in general use are rated at from 100 cp to 3000 cp, but it is expected that 50-cp units will soon be placed on the market. Gas-filled lamps are rapidly replacing arcs for exterior illumination, Mr. Stone declares, while for interior use both direct-lighting and indirect-lighting fixtures are to be seen, although the proper selection of fixtures suitable for the gas-filled lamps does not appear to have received the attention that it requires. Mr. Stone thinks that there is no doubt that a large demand for gas-filled lamps in the Argentine Republic will be evident in the near future. But the present, insists Mr. Stone, is the time for American manufacturers to exert themselves.

Wire Manufacturer Adopts Profit-Sharing Plan.—The Belden Manufacturing Company of West Twenty-third Street and South Western Avenue, Chicago, Ill., maker of rubber-insulated wires, cables and kindred products, has announced the details of a plan for sharing profits with its employees. The directors of the company have authorized the sale of 500 shares of the company's stock to employees at $100 a share, payment to be made in instalments extending over a five-year period. On the employees' stock a special bonus at the rate of $5 a share will be credited June 15, 1916, and annually thereafter, as long as the employee remains with the company. Dividends will also be credited to the stock. "The adoption of this plan will promote the welfare of both company and employees," said President Joseph C. Belden. "I believe that the cost of the bonus, which will not exceed $2,500 annually, will be saved through the increased efficiency and economy induced by the employees' interest."

Ornamental Lighting Standards for the City of New York.—The J. L. Mott Iron Works, Fifth Avenue and Seventeenth Street, New York, has received an order from the city of New York for 1500 ornamental poles of a newly developed type, for use with nitrogen-filled "Novolux" lamps. The units will be of cast iron and wrought iron, the latter material being employed to strengthen the poles and thereby lessen the liability of injury to pedestrians and passers-by in case of vehicles coming into collision with the posts. The latter are to be of a special ornamental design, approved by the Municipal Art Commission, which is composed of sculptors and architects appointed by the Mayor. Besides the above order, the J. L. Mott company manufactured some 21,000 posts now installed in Greater New York. The company recently received an order for 100 ornamental standards from the city of Port Jervis, N. Y., 150 standards from the city of Spring Lake, N. J., and 150 standards from the city of Havana, Cuba, all of which will be the single-unit type for nitrogen-filled lamps.

The Prest-O-Lite Company to Make Storage Batteries.—The Prest-O-Lite Company, Indianapolis, Ind., manufacturer of acetylene lighting systems and oxy-acetylene welding apparatus, has recently purchased the plant and business of the Pumpelly Battery Company of Indianapolis, and will make several types of batteries for ignition service and for the lighting and starting of automobiles. Temporarily, the Prest-O-Lite company will utilize the plant of the Pumpelly company to manufacture the storage cells. New buildings, however, will be erected shortly at the Speedway plant of the company in Indianapolis, where, it is reported, the batteries will be manufactured on a large scale. The present output of the Pumpelly plant is about 400 sets of cells a day. Mr. Harry Murphy, president of the Pumpelly Battery Company, has been made a vice-president of the Prest-O-Lite Company and will have active charge of the battery department. Mr. Murphy has been identified with the storage-battery industry since 1907, when he purchased the Western Storage Battery Company and organized the Pumpelly Battery Company.

NEW YORK METAL MARKET PRICES

	June 1 Selling Prices Bid	June 1 Selling Prices Asked	June 8 Selling Prices Bid	June 8 Selling Prices Asked
Copper:	£ s d		£ s d	
London, standard spot*	78 17 6		82 10 0	
Prime Lake	18.87½ to 19.12½		19.50 to 19.75	
Electrolytic	18.62½ to 18.87½		19.50 to 19.75	
Casting	17.37½ to 17.62½		18.50 to 18.75	
Copper wire base	20.00 to 20.50		20.75 to 21.00†	
Lead	4.90		5.75	
Nickel	45.00 to 48.00		45.00 to 48.00	
Sheet zinc, f.o.b. smelter	24.50		30.00†	
Spelter	22.50 to 23.50†		26.00 to 27.00†	
Straits tin	38.00		40.25	
Aluminum, 98 to 99 per cent	26.00 to 27.00		28.00 to 29.00	

*OLD METALS

Heavy copper and wire	17.00	17.75
Brass, heavy	11.50	13.00
Brass, light	9.75	11.25
Lead, heavy	4.50	5.25
Zinc, scrap	20.00	21.00

*COPPER EXPORTS

Total tons to June 8	7,911

*From daily transactions on the New York Metal Exchange.
†Nominal.

New Incorporations

The Wabeno Lighting Company, of Wabeno, Wis., has been chartered with a capital stock of $5,000 by G. W. Jones, H. C. Humphrey and R. H. Jones.

The Jennings Electric Company, of Jennings, La., has been incorporated by Robert B. Montgomery, D. Gaylord Powell and Harry A. Kolb. The company is capitalized at $5,000.

The Elizabeth Light & Power Company, of Elizabeth, Ill., has been organized with a capital stock of $6,600 by Bernhard Dittmar, N. A. Gault, A. L. Cox, John Hagie, Frank Fraser, J. C. Mckenzie and S. B. Reynolds.

New Industrial Companies

The Pruver Electric Company, of New York, N. Y., has been chartered with a capital stock of $5,000 to deal in supplies, machinery, sewing machines, etc. The incorporators are David Stromberg, Clement J. Lipman and Max Sandak, 88 East Tenth Street, New York, N. Y.

The Industrial Equipment Company, of Stapleton, N. Y., has been incorporated with a capital stock of $10,000 to manufacture electrical and mechanical apparatus, etc. The incorporators are J. J. Donohue, S. B. Vondersmith, A. H. Ferber, 8 Murray Street, Stapleton, N. Y.

The Batavia Switchboard Company, of Batavia, N. Y., has been incorporated by E. Russell, C. A. Willyoung and E. G. Schattle, of Batavia, N. Y. The company is capitalized at $35,000 and purposes to manufacture and install switchboards; also to do an electrical engineering business, etc.

The Brocklen Underground Electric Manufacturing Company, of Glenside, Pa., has been chartered with a capital stock of $5,000 for the purpose of manufacturing electrolysis bonds, tools and specialties for underground construction work. E. L. Brockway is president of the company and T. C. Allen treasurer.

The Conduit-Miller Company, of Syracuse, N. Y., has been incorporated with a capital stock of $45,000 to do a general electrical contracting business, deal in supplies and operate stores. The company is a consolidation of the Conduit Electric Company and the Miller Electric Fixture Company, both of Syracuse. The incorporators are: P. L. Salmon, 734 South Crouse Avenue; I. D. Perry and H. M. Salmon, all of Syracuse, N. Y.

The Shawinigan Electro Products Company, of Highlandtown, Md., has been incorporated with a capital stock of $250,000 for the purpose of erecting a plant at Highlandtown to manufacture ferro-silicon and calcium carbide. J. E. Aldred, president, and Charles E. F. Clarke, vice-president and treasurer, of the Pennsylvania Water & Power Company, 24 Exchange Place, New York, N. Y., are interested in the Shawinigan company.

Trade Publications

Steel.—Ellsworth Haring, 114 Liberty Street, New York, has issued a folder which lists various kinds of steel and metal specialties.

Heat Regulators.—The Minneapolis (Minn.) Heat Regulator Company has issued folders which describe its motor-driven heat regulator.

Test Clip.—R. S. Mueller & Company, 423 High Avenue, S. E., Cleveland, Ohio, are sending out a leaflet which describes and illustrates a 20-amp test clip.

Wiring Devices.—Catalog No. 800 recently issued by the Fargo Manufacturing Company, Poughkeepsie, N. Y., contains information on various types of wiring devices.

Steam-Purifying Apparatus.—Catalog No. 10 issued by the Tracy Engineering Company, San Francisco, Cal., describes and illustrates apparatus for purifying steam.

Small Motor-Generator Sets.—Motor-generator sets for battery charging and signal work are described in a bulletin issued by the Electric Specialty Company, Stamford, Conn.

Reflectors for Display Windows.—The Simplex Conduits, Ltd., Garrison Lane, Birmingham, England, is sending out Bulletin No. 583, entitled "Window Lighting Reflectors."

Rotating Switch.—Harvey Hubbell, Inc., Bridgeport, Conn., has prepared a folder which describes the Hubbell-Caldwell rotating switch for ornamental lighting fixtures.

Profit-Sharing Project.—The Hotpoint Electric Heating Company, Ontario, Cal., has issued a folder which describes a profit-sharing campaign which it has inaugurated for the summer.

Electric Tools.—Catalog No. 6A published by the Cincinnati (Ohio) Electrical Tool Company contains information on various types of portable electrical drills, grinders and reamers.

Extension Attachments.—The Arrow Electric Company, Hartford, Conn., has prepared several leaflets which describe its extension attachments for pull sockets and rosette pull switches.

Portable Electric Tools.—A. F. Carver & Company, 865 Washington Street, Newtonville, Mass., have issued an illustrated folder which describes several of their portable electric tools.

Pencil Flashlamp.—The Hawthorne Manufacturing Company, 35 Spruce Street, Bridgeport, Conn., has issued a leaflet which describes a flashlamp with an attachment for holding a pencil.

Automobile Lamps.—The Mac Manufacturing Company, for which A. Hall Berry, 97 Warren Street, New York, is sole sales agent, has issued a leaflet which describes its "no-glare lamp bulbs."

Fixtures for Nitrogen-Filled Lamps.—T. C. White Company, 1122 Pine Street, St. Louis, Mo., has prepared a leaflet which describes several of its fixtures for high-efficiency incandescent lamps.

Headlamps.—The Esterline Company, Indianapolis, Ind., has just published Catalog No. 364, which is attractively illustrated in colors and which describes various types of its electrically operated headlamps.

Electric Egg-Testing Apparatus.—The Wm. Rigling Egg Tester & Manufacturing Company, Hamilton, Ohio, has issued several folders which describe and illustrate its electrically operated egg-testing devices.

Outdoor-Substation Equipment.—The Delta-Star Electric Company, 617 West Jackson Boulevard, Chicago, Ill., is sending out Leaflet No. 720, which describes and illustrates several outdoor-substation installations.

Electric Fire-Alarm Apparatus.—The American Telephone Fire Alarm Company, 208 South La Salle Street, Chicago, Ill., has issued Bulletin No. 3, which describes and illustrates some of its fire-alarm apparatus.

Attachment Plugs and Receptacles.—Harvey Hubbell, Inc., Bridgeport, Conn., is sending out a large-sized wall hanger which contains illustrations of the separable attachment plugs and wall and flush receptacles made by that firm.

Light-Weight Vacuum Cleaner.—The Santo Manufacturing Company, Twenty-first Street and Allegheny Avenue, Philadelphia, Pa., has issued a folder which describes a recently developed vacuum cleaner with the motor above the bag.

Exhibit of Hydraulic Apparatus.—The Pelton Water Wheel Company, San Francisco, Cal., is sending out an illustrated bulletin which describes its exhibit of hydraulic apparatus and auxiliary equipment at the Panama-Pacific Exposition.

Porcelain-Enameled Reflectors.—The Sun Electrical Company, Ltd., 118 Charing Cross Road, London, W. C., England, has prepared List No. 267, which describes and illustrates its porcelain-enameled reflectors for high-efficiency incandescent lamps.

Electrical Apparatus.—The General Electric Company, Schenectady, N. Y., has recently published Bulletin No. 44,406 on its ventilated commutating-pole railway motor, Bulletin No. 48,303 on its hand-operated starting rheostats and panels for direct-current motors, and Bulletin No. 41,013 on its direct-current commutating-pole motors designated as type RC.

Construction News

New England

JACKMAN, MAINE—The power station owned by B. W. Page, of Jackman, was recently destroyed by fire. The town will be without electrical service until the plant is repaired.

PORTLAND, MAINE. — Arrangements have been completed by the Cumberland County Pwr. & Lt. Co., of Portland, for erecting a transmission line from North Gorham to Sebago Lake Station and thence to North Standish, a distance of 6 miles.

MANCHESTER, N. H.—Work has begun on the construction of the addition to the power plant of the McElwain Company in South Manchester. The plans provide for the installation of four 400-hp boilers, also engines and generators, increasing the output of the plant by 1600 hp. A storage battery will also be installed. The cost of the building and equipment is estimated at $150,000. Fred T. Ley & Co., of Springfield, Mass., are general contractors.

BRANDON, VT.—Water rights in the Neshobe River, formerly known as the lower mill dam, have been purchased by the Neshobe El. Co. The sawmill and storage building, situated on the bank of the river, were also included in the sale.

PETERSHAM, MASS.—If sufficient business is guaranteed, the Athol Gas & El. Co., of Athol, will extend its transmission lines to Petersham. The cost of erecting the transmission line and installing system is estimated at between $10,000 and $15,000.

WEST NEWBURY, MASS.—At an election held recently the proposal to install a municipal electric-light plant was defeated.

WORCESTER, MASS.—Preparations are being made by the Worcester El. Lt. Co. for extensions to its power house on Webster Street, which will provide space for the installation of six 1250-hp boilers with necessary mechanical stokers, superheaters, blowers, steam piping, etc. Two 1250-hp boilers of the Hornsby-Bigelow type have been ordered, together with superheater for same. The mechanical stokers, water heaters and feed-water pump are to be ordered very soon. The coal-conveying equipment will also be extended. Henry R. Kent & Co., 141 Broadway, New York, N. Y., are designing and constructing engineers. R. W. Rollins is president and general manager.

NEW HAVEN, CONN.—The contract for the construction of a power station at the plant of the Winchester Repeating Arms Co. has been awarded to the Westinghouse, Church, Kerr Co., of Boston. The building will be 90 ft. by 50 ft., with an ell 45 ft. by 70 ft., one story high, and will cost $30,000.

SOUTH NORWALK, CONN.—The installation of an ornamental street-lighting system in a section of the town is under consideration. It is proposed to use combination poles with arms for tungsten lamps, the poles to be extended upward so as to carry wires and trolley span-wire supports. Plans are also being considered for the installation of a 250-kw motor-generator set, receiving current at 11,000 volts alternating current at motor, and delivering 230 volts to 270 volts direct current at generator end. As yet nothing definite has been decided upon. A. E. Winchester is general superintendent.

Middle Atlantic

ALBANY, N. Y.—The Board of Contract and Supply has directed Secretary Wachsman to advertise for electrical equipment for School 14 and also for electric lamp-posts for the Albany Basin Bridge.

BROOKLYN, N. Y.—Bids will be received by the Department of Public Charities, tenth floor, Municipal Building, New York, N. Y., until June 17 as follows: (1) For furnishing and erecting blowers, engines and air ducts in connection with mechanical draft installation in 12 boilers of the power plant of the Kings County Hospital, borough of Brooklyn; (2) for furnishing and installing dumping grates necessary for 12 return tubular boilers, and certain supplies and work in repairing brickwork in the furnaces of said boilers, situated in the power plant of the Kings County Hospital. Blank forms and further information may be obtaind at the office of the contract clerk of the department. John A. Kingsbury is commissioner.

DEANSBORO, N. Y.—The Public Service Commission has approved the transfer of the plants, franchises and contracts for furnishing electricity in the towns of Marshall and Kirkland from Olin E. Blanding to Fred L. Nelson, of Deansboro.

HERKIMER, N. Y.—The Board of County Supervisors has adopted a resolution authorizing the purchasing agent to install an electric-lighting system in the County Home buildings and also to ask for bids for supplying electricity for same.

NEWPORT, N. Y.—The application of the Middleville El. Lt. Co., of Middleville, to erect electric transmission lines and exercise rights and privileges under a franchise in Newport has been approved by the Public Service Commission.

NEW YORK, N. Y.—Bids will be received by J. T. Fetherston, commissioner of street cleaning, Room 1244, Municipal Building, New York, until June 16 for furnishing materials and construction of tracks and contact rails on the pier at the foot of East Nineteenth Street, Borough of Manhattan, installation of electrical work and equipment incidental thereto, and the alteration and repairs of said pier. Blank forms, plans and drawings and further information may be obtained at the above office, for which a deposit of $10 will be required.

OSWEGO, N. Y.—The Diamond Match Co. has awarded a contract for the construction of a new power house in Oswego to Peter Reby. The new plant will be 88 ft. by 80 ft. with smokestack 235 ft. high. The equipment will include two 500-hp boilers (space will be provided for a third one of same size) and two 1000-kw turbo-generators. Boilers will be equipped with all labor-saving devices, including automatic stokers.

PARISHVILLE, N. Y.—The Public Service Commission has approved the transfer of the local electric-lighting plant and franchises, if any, owned by S. L. Clark & Sons, of Parishville, to the A. Sherman Lumber Co., of Potsdam.

PERRY, N. Y.—The Perry El. Lt. Co. will extend its transmission lines to Warsaw, a distance of about 20 miles; 35-ft. wooden poles and No. 4 triple-braid, weatherproof wire will be used. No contracts will be awarded for the work. C. W. Torrey is superintendent.

CAMP HILL, PA.—The Town Council has authorized the property committee to contract with the United El. Co., of Lemoyne, for lighting the streets of the town. Lamps of 32 cp will be used.

COLUMBIA, PA.—The installation of an ornamental lighting system in the business district is under consideration. The plans provide for the erection of 64 standards, to cost about $1,500.

HARRISBURG, PA.—The Harrisburg Lt. & Pwr. Co. has secured the contract for installing a new lighting system in the Reilly Street yards of the Pennsylvania Railroad at Trenton, N. J.

HARRISBURG, PA.—The Simplex Surface Contact Co., Market Square, Harrisburg, has secured contracts for the construction of two underground electric transmission systems, one being placed by the Bethlehem Steel Co. and the other by the Lehigh Coal & Navigation Co.

HARRISBURG, PA.—The Public Service Commission has approved of the following contracts: The Dubois El. Co., of Dubois, and the borough of Falls Creek for furnishing street-lighting service; the West Penn El. Co., of Pittsburgh, and the borough of Dawson for lighting the streets of Dawson; the Duquesne Lt. Co., of Pittsburgh, and the boroughs of Westwood, Verona and Crafton for furnishing electric lamps. The Duquesne Lt. Co., of Pittsburgh, has given notice that application will soon be made for approval of a contract for street-lighting with the borough of Mount Oliver.

MUNCY, PA.—Bids will be received by Frank Smith, secretary of the building commission, State Board of Charities, Capitol Building, Harrisburg, until June 30 for construction of new buildings (cottage system) known as the administration building, and four cottages pertaining to an Industrial Home for Women at Muncy, Lycoming County. Separate bids are also asked for plumbing, ventilating apparatus and electrical equipment. Drawings and specifications may be secured on application at the office of Horace Trumbauer, architect, Land Title Building, Philadelphia, upon deposit of $100, of which $90 will be refunded upon refusal of any bid.

BLUEFIELD, W. VA.—The installation of a municipal electric-light plant is being considered by the City Council.

PETERSBURG, VA.—Bids will be received by P. G. Bunting, manager, P. O. Box 11, Petersburg, until June 21, on the right or franchise to construct and maintain for a term of 15 years along the streets and alleys at West City Point Subdivision at Hopewell, near City Point, Prince George County, electric transmission lines, for furnishing electricity for lamps, heaters and motors, also for lines for telephone and telegraph service, etc.

WASHINGTON, D. C.—Bids will be received at the office of the superintendent of the United States Capitol Building and Grounds, Washington, D. C., until June 16 for lighting fixtures for the Columbia Hospital. Further information may be obtained on application to Elliot Woods, superintendent.

WASHINGTON, D. C.—Foreign trade opportunities are announced by the Bureau of Foreign and Domestic Commerce in the Commerce Reports as follows: No. 17,002—A firm in Italy informs an American consular officer that it desires to receive offers from American manufacturers of copper wire and unmounted turrets for electric lines. No. 17,019—An American consular officer in Italy has transmitted a detailed report relative to a possible market for the sale of American incandescent lamps with drawn filaments, both in the vacuum and the concentrated filament gas-filled types. No. 17,094—An American consular officer in Greece reports the name and address of a firm in his district which is in the market for lubricating oils, dynamos and electrical supplies. No. 17,107—An American consular officer in Greece reports the name and address of a company in his district which desires to receive catalogs and full information relative to agricultural machinery, magneto and regular-type spark plugs; leather belting, etc. The firm, it is stated, also imports pumps, oil engines, hardware, minerals, etc. No. 17,124—An American consular officer in Italy reports that an American firm is contemplating the erection of a marble plant in his district and that one of the directors is desirous of obtaining catalogs from American manufacturers of marble machinery and power equipment. Further information may be obtained at the Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., or its branches.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until June 22 to furnish at the various navy yards and naval stations supplies as follows: Puget Sound, Wash., schedule 8342—one electrolytic, oxygen-hydrogen generating plant. Mare Island, Cal., schedule 8343—one circulating pump. Philadelphia, Pa., schedule 8418—49 water-tight telephone stowage boxes, 27 canvas bags for telephone stowage; schedule 8401—one electrically driven pump. Newport, R. I., schedule 8416—250 air-pressure gages; schedule 8415—700 lb. copper pipe and copper tubing; schedule 8435—eight overhead trolley hoists. Brooklyn, N. Y., schedule 8427—miscellaneous oil and vacuum compound steam gages; schedule 8426—500 igniters and 86 spark plugs for same; 5900 schedule 8436—six watt-hour meters and spare glass covers; schedule 8441—three electrically operated ice-cream freezers and spare parts, four electrically operated meat and food grinders and spare parts, three electrically operated dishwashing machines and spare parts, three electrically operated dough-mixing machines and spare parts, three electrically operated kitchen and cake machines and spare parts, four electrically operated potato peelers and spare parts; schedule 8440—four electric baking ovens, U. S. Navy standard, and two sets spares. Washington, D. C., schedule 8439—one electric locomotive, industrial type, 600 volts, direct current; schedule 8403—two induction motors; schedule 8404—two centrifugal volume exhausters. Charleston, S. C., schedule 8418—6840 lb. condenser tubes. Boston, Mass., schedule 8425—miscellaneous cast-steel crucible wire. Key West, Fla., schedule 8414—2700 ft. 66,000-circ. mil and 400,000-circ. mil cable. Portsmouth, N. H., schedule 8418—three ringing telephone dynamotors, miscellaneous telephones and switchboards and spare parts. Bids will also be received until June 29 as follows: East and West, schedule 8448—14,250 flashlight batteries, 4350 flashlights without batteries. Brooklyn, N. Y., schedule 8442—furnishing and installing 67,174 sq. ft. cork insulation. Bids will also be received until July 6 as follows: Brooklyn, N. Y., schedule 8445—miscellaneous pressure and vacuum gages, f.o.b. works; schedule 8444—20 transmission optical range-finder systems. Applications for proposals should give the schedule desired by number.

North Central

DETROIT, MICH.—A new power plant is being installed at the plant of the Lansing Co., which will supply electricity to all the buildings. A second unit, it is understood, will be installed for emergency purposes.

FREMONT, MICH.—The City Commission has decided to install an ornamental lighting system on Main Street. The single lamp standard is favored.

GRAND RAPIDS, MICH.—Steps have been taken by the South Division Center Improvement Association for the installation of ornamental lamps on Division Avenue from Wealthy Street to Hall Street. The cost of the system is estimated at $18,800, of which, it is understood, $16,000 is available.

HIGHLAND PARK, MICH.—The Peninsular El. Lt. Co., of Detroit, has submitted a proposal to the Village Council for installing an ornamental lighting system on Woodward Avenue. The plans provide for ornamental standards carrying 1000-cp incandescent lamps, to cost about $12,000, the work to be done by the company.

THREE RIVERS, MICH.—Plans, it is reported, have been submitted by George Champe, civil engineer, of Toledo, Ohio, for construction of municipal electric-lighting plant and water-pressure plant, for which $50,000 in bonds have been voted.

CANTON, OHIO.—An ordinance will be submitted to the City Council permitting the Canton El. Co. and the Northern Ohio Trac. Co. to lay conduits on Tuscarawas Avenue in order to place their wires underground.

CLEVELAND, OHIO—Bids will be received at the office of the commissioner of purchases and supplies, Room 511, City Hall, Cleveland, until June 18 for rubber-covered, lead-incased cable for the municipal Electric Light Department. Specifications may be obtained at the office of the commissioner of the light and heat division, No. 1443 East Third Street.

COLUMBUS, OHIO.—The refuse disposal plant, established recently at the abandoned West Side pumping station, adjoining the municipal electric-lighting plant, will be operated as an auxiliary to the municipal lighting station, to which it will furnish all surplus steam.

CORTLAND, OHIO—The contract for the construction of the power plant of the Cortland Ltg. & Pwr. Co. has been awarded to the John El. Co., of New Castle, Pa. The equipment will include one 50-kva generator, switchboard complete, transformers, etc.; distributing system to consist of 400 cedar poles and 5 miles of wire, 80 meters and 95 series incandescent lamps. Electricity for operating the system is obtained from the power plant of the Richards & Evans Co., of Cortland.

DAYTON, OHIO.—The West Dayton Civic League is promoting a project to extend the ornamental street-lighting westward from the center of the city for a distance of more than a mile on Third and Fifth Streets. William S. Crandall is chairman of the publicity committee.

MASSILLON, OHIO.—The Massillon El. & Gas Co. has engaged Ward Harrison, of Cleveland, to prepare plans and specifications for the proposed new street-lighting system for Massillon.

NEWCOMERSTOWN, OHIO.—The Ohio Ser. Co., of Coshocton, has closed a deal for the purchase of ten acres of land in Newcomerstown, to be used as a site for a new power plant.

PORT CLINTON, OHIO.—The City Council has entered into a contract with the Port Clinton El. Lt. & Pwr. Co. to maintain the new ornamental street-lighting system at $4,000 per year. Plans have been prepared for installation of the system.

RUSSELL, OHIO—The City Council has granted the Ohio Valley El. Lt. Co. of Ironton, a 20-year franchise to supply electricity in Russell. Electricity will be used only for commercial and residential lighting as gas is used for street lighting. A. L. Thuma, of Ironton, is local superintendent.

SMITHVILLE, OHIO—The Wooster El. Co., of Wooster, has been granted a franchise to supply electricity in Smithville. The company will erect a transmission line from Wooster to Smithville. C. V. Hard is president and general manager of the company.

SPRINGFIELD, OHIO.—Steps have been taken by the merchants for the installation of an ornamental lighting system in the business district.

TILTONSVILLE, OHIO. — The Village Council has contracted with the Jefferson El. Co., of Steubenville, to install an electric-lighting system. Electricity to maintain same will be obtained from the Wheeling Trac. Co., of Wheeling, W. Va.

TOLEDO, OHIO—The Public Utilities Commission has granted the Dayton Pwr. & Lt. Co. permission to issue $172,000 in capital stock, the proceeds to be used to increase the output of the plant from $20,000 hp to 30,000 hp.

XENIA, OHIO—The installation of an ornamental street-lighting system in the business district is under consideration. The street lighting is furnished by the Dayton Pwr. & Lt. Co., of Dayton.

HARLAN, KY.—The John A. Stewart El. Co., Penobscot Building, Detroit, Mich., is reported to be contemplating the construction of an electric-power plant in or near Harlan to supply electricity throughout the coal fields. As yet nothing definite has been decided upon.

HORSE CAVE, KY.—The local electric-light plant is reported to have been purchased by J. P. Todd, manager of the Kentucky Utilities Co., of Elizabethtown. A company has been organized under the name of the Horse Cave Lt. & Pwr. Co. to operate the system.

ASHLEY, IND.—The Public Service Commission has granted the Indiana Utilities Co., of Angola, permission to purchase the municipal electric-lighting system in Ashley. The power plant was lately damaged by fire.

BREMEN, IND.—The Hawks El. Co., of Goshen, will extend its transmission line to Bremen to supply electricity here. The equipment will include one switchboard, three 75-kva and three 50-kva, 2200/13,200-volt transformers, one outdoor substation (steel tower); transmission line will require 400 white cedar poles and 60 miles of No. 4 solid wire. Owen C. Cover is general manager.

HARTFORD CITY, IND.—Preparations are being made by the American Window Glass Co. for extensions to its plant in this city to cost about $100,000, which will include 10 mixing and storage tanks, six large concrete tanks, four smaller steel tanks, overhead electric railway and two movable elevators.

INDIANAPOLIS, IND.—The Mechanics' Ht. & Lt. Co., of Indianapolis, have placed contracts and will install within the next four months one 1500-kw Westinghouse rotary converter in a new substation and one 6250-kva turbo-generator unit in its West Washington Street plant, with necessary station equipment and switches for both stations. Hugh H. Harrison is president.

LIGONIER, IND.—Lyon & Greenleaf, owners of the local electric-light plant, are building an addition to their power house and erecting a new smokestack. They have also purchased a new Babcock & Wilcox boiler and two Jones underfeed stokers. A. W. Lyon is manager.

NEW ALBANY, IND.—The United Gas & El. Co., of New Albany, has applied to the Public Service Commission for permission to issue $8,000 in bonds, the proceeds to be used for improvements and extensions.

ALTON, ILL.—The Alton Gas & El. Co. is negotiating with the City Council for the installation of a new street-lighting system.

BEARDSTOWN, ILL.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until July 9 for construction, including mechanical equipment, lighting fixtures and approaches, of the United States post office at Beardstown, Ill. Drawings and specifications may be obtained at the above office or from the custodian at Beardstown.

MATTOON, ILL.—The combination of the municipal electric-lighting plant and water-works system is under consideration by the City Council. Plans and specifications are being prepared by C. L. James, city engineer.

ALBERT LEA, MINN.—Bids will be received by H. J. Harm, Albert Lea, until June 24 for the construction, including general contract, heating, plumbing and electrical wiring, of a six-story office building, in accordance with plans and specifications prepared by Hoffman & Mosse, architects, of Rochester and Albert Lea, which may be seen at the offices of the architects and H. J. Harm, Albert Lea, and at the Builders' Exchanges in St. Paul, Minneapolis and Duluth, Minn.; Chicago, Ill., and Milwaukee, Wis.

FARIBAULT, MINN.—The Consumers' Pwr. Co., of Faribault, has been granted a franchise and street-lighting contract from the village of Rosemount. Arrangements are being made by the company to extend its transmission lines to Goodhue to supply electricity for lamps and motors there.

ODESSA, MINN.—Bids will be received by the Board of Education at the office of H. H. Reindl, clerk, Odessa, until June 19 for construction of a high-school building, separate bids to be submitted as follows: (1) General contract work; (2) heating and ventilating; (3) plumbing; (4) electric wiring; (5) gas piping. Plans and specifications are on file in the office of Edwins & Edwins, architects, Northwestern Building, Minneapolis, and at the office of the clerk of board, Odessa.

PAYNESVILLE, MINN.—At an election held recently the citizens voted to sell the municipal electric-light plant to A. G. Whitney, president of the Union Pwr. Co., of St. Cloud.

WACONIA, MINN.—The Waconia Lt. & Pwr. Co., recently organized, is installing an electric-lighting system in Waconia. A transformer station will be erected and will be equipped with 33,000/2200-volt transformers, switchboard for 50 lamps and one three-phase distributing board; distributing system will require 400 poles and 3½ tons No. 6 wire and 3500 ft. armored cable for ornamental lighting system; from 800 to 1000 incandescent lamps will be required. Electricity to operate the system will be secured from the Minneapolis General Electric Co. E. F. Strong is engineer in charge.

CHARLES CITY, IA.—The Cedar Valley El. Co., controlled by the American Gas Co., of Philadelphia, Pa., has purchased the property and franchises of the Cedar Valley Pwr. Co. The Cedar Valley El. Co., it is understood, proposes to erect transmission lines to connect Hansell, Dumont, Bristow and Allison with the Hampton plant, to furnish electricity in those towns. The headquarters of the Cedar Valley El. Co. will be located in Charles City.

COLO, IA.—The Town Board has granted the Iowa Ry. & Lt. Co., of Cedar Rapids, a franchise to supply electricity in Colo.

ODEBOLT, IA.—At an election held recently the proposal to grant Messrs. Russell & Frye, of Corydon, a franchise to construct and operate an electric-lighting plant in Odebolt was carried.

CHARLESTON, MO.—The Missouri Public Utilities Co., of Cape Girardeau, has been granted a franchise to erect an electric transmission line from Charleston to East Prairie, a distance of 12 miles, to supply electricity in the latter city.

KIRKSVILLE, MO.—The City Commission has decided to call an election June 24 to submit the proposal to issue $70,000 in bonds for improvements to the water-works and to install a complete street-lighting system.

LINTON, N. D.—The installation of an electric-light plant in Linton is under consideration. A. M. Baker, of Morris, Minn., is reported interested in the project.

MICHIGAN, N. D.—Steps, it is reported, have been taken toward the installation of an electric-lighting plant in Michigan.

PISEK, N. D.—The Council is considering the question of installing a municipal electric-light plant in Pisek.

DAVENPORT, NEB.—Contracts, it is reported, will soon be awarded by the city of Davenport for the construction of a municipal electric-light plant. Charles F. Sturtevant, of Holdredge, is consulting engineer.

EDGAR, NEB.—Deputy Attorney General Barrett, in an opinion handed down May 23, held the $13,000 bond issue of the city of Edgar to be legal and directed the auditor to register the bonds. The proceeds will be used for extensions and improvements to the municipal electric-lighting plant.

GRAND ISLAND, NEB.—Permission has been granted by the State Board of Irrigation to the Grand Island El. Co. to construct a hydroelectric power plant on the Platte River, near Grand Island, to develop about 670 hp. The cost of the proposed plant is estimated at $55,000. F. H. Fritts and W. H. Thompson, of Grand Island, are reported interested in the project.

SYRACUSE, NEB.—The proposal to issue $20,000 in bonds for the installation of a municipal electric-light plant and water-works system will be submitted to the voters on June 21. The Martz Engineering Co., First National Bank Building, Lincoln, is consulting engineer.

CHANUTE, KAN.—The city engineer, it is reported, has been authorized to prepare plans for extensions and improvements to the municipal electric-light plant and water-works system, to include one engine, one 250-kva generator (directly connected), one recording steam gage, feed pump, etc., for the electric plant for water-works, one low-service pump directly connected to electric motor and two high-service pumps and one booster pump.

CHAPMAN, KAN.—The city of Chapman has purchased the electric plant of the Dickson County Lt. & Wtr. Co., to be owned and operated by the municipality. The system will be remodeled.

ROBINSON, KAN.—At an election to be held June 24 the proposal to issue bonds for the installation of a municipal electric-lighting plant will be submitted to the voters.

Southern States

WARSAW, N. C.—The City Council has granted a franchise to Messrs. Oliver and Pettit, of Clinton, to construct and operate an electric-light plant in Warsaw.

ATLANTA, GA.—Bids will be received by F. H. Duehay, superintendent of prisons, Department of Justice, Washington, D. C.,

until June 18 for furnishing at the United States Penitentiary, Atlanta, Ga., electric wiring for bath, laundry and tailor-shop building.

ATLANTA, GA.—The Atlantic Stone Co., which owns extensive quarries and water rights on Broad River in Elbert County, has changed its name to the Atlantic Pwr. & Properties Co. and has increased its capital stock from $30,000 to $60,000. The company has also obtained permission to construct hydroelectric power plants. William Hurd Taylor, Georgia Building, Atlanta, is treasurer.

JACKSON, GA.—Within the next two months the electric light commission expects to purchase one carload of 30-ft. and 35-ft. poles, pole-line hardware, transformers, meters and series regulators. W. E. Merck is superintendent.

MADISON, GA.—Within the next two months the managers of the municipal electric-light plant expect to purchase a few electric irons. G. W. Hubbard is superintendent.

QUITMAN, GA.—Foundations are being erected for two unaflow 450-hp Ames engines at the municipal electric-light plant. A six-panel General Electric switchboard and two 174-hp Sterling boilers are being installed. Two 250-kva alternators, pump and condenser outfit have been purchased. F. C. Hertz is superintendent.

SAVANNAH, GA.—The Savannah El. Co. is building an underground 13,000-volt transmission line from Riverside station to Mill Haven, Mill district, two 4-0, two-phase cables and six ducts. H. C. Foss is manager.

TOCCOA, GA.—At an election held recently the proposal to issue $35,000 in bonds for the installation of an electric-light plant was carried.

VILLA RICA, GA.—The Villa Rica El. Lt. & Pwr. Co. will purchase complete wire appliances for a 14-room house. W. B. Powell is general manager.

BROOKSVILLE, FLA.—The City Council has awarded the contract for street lighting to the Brooksville El. Co., the contract to take effect early in July.

DAYTONA, FLA.—Within the next six months the Daytona Pub. Serv. Co. expects to purchase electric irons, toasters, lamps and fans. Ira A. Blalock is business manager.

ST. AUGUSTINE, FLA.—Plans are being considered, it is reported, by the Jacksonville & St. Augustine Pub. Ser. Corpn., for the installation of an electric-power plant.

BRAEMER, TENN.—The Braemer Pwr. Co., recently organized, contemplates the construction of a hydroelectric power plant at Braemer Falls on Laurel Creek, to develop about 1000 hp. The present plans provide for the construction of a dam 100 ft. high and to convey water from dam by flume to mountainside, where penstocks will convey water to waterwheels. The officers are: W. P. Dungan, president; Sexton W. Dungan, vice-president; L. D. Gastieger, secretary and treasurer, and J. H. Graveson, general manager.

BIRMINGHAM, ALA.—The Alabama Pwr. Co., of Birmingham, is reported to be contemplating extending its transmission lines to Guntersville, Albertville and Boaz.

OPELIKA, ALA.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until July 14 for construction complete, including mechanical equipment, except elevator, lighting fixtures and approaches, of the United States post office building at Opelika. Drawings and specifications may be obtained at the above office or from the custodian of site at Opelika.

ARKADELPHIA, ARK.—The Arkansas Lt. & Pwr. Co. is improving the plant of the Co-operative El. Lt. Co., of Newport, which it recently purchased, and, it is understood, will erect a transmission line to Diez and Tuckerman.

MONTICELLO, ARK.—Within the next two months poles and line material will be needed for the municipal electric-lighting system. Dickinson & Watkins, engineers, Little Rock, Ark., have charge of the management of the water and light plant and sewerage system in Monticello.

ABILENE, TEX.—The Abilene Gas & El. Co. is extending its transmission line from Abilene to Cisco, Clyde, Putnam and Baird to furnish electrical service. The transmission will require 2500 30-ft. cedar poles and line hardware. A. V. Wainwright is vice-president.

DAWSON, TEX.—F. H. Meyer, of Teague, it is reported, is contemplating the installation of an electric-lighting system in Dawson.

HIGHLAND PARK, TEX. (not a post office)—The City Council has awarded the Dallas El. Lt. & Pwr. Co. a contract to install 37 ornamental lamps. The cost of the system is estimated at $9,500.

Pacific States

COLVILLE, WASH.—The Stevens County Pwr. & Lt. Co., of Colville, has petitioned the Commissioners of Stevens County for a franchise to construct and maintain a ditch over and across Aris public road for conveying water from the Colville River, to be used to generate electricity. The company, it is reported, contemplates extensive improvements to its system in and near this city during the summer.

EPHRATA, WASH.—C. J. Weller, of Wilson Creek, it is reported, will install an electric-lighting system in Ephrata. The City Council has announced its intention of negotiating with Mr. Weller for the installation of a street-lighting system, consisting of 30 lamps of 100 cp.

FRIDAY HARBOR, WASH.—The Friday Harbor El. Co. is installing an electric-lighting plant in Friday Harbor under the franchise recently granted to R. D. Burghardt, 89 Marion Street, Seattle. W. H. Ballentine is manager of the company.

HOQUIAM, WASH.—At an election to be held June 7 the proposal to grant George H. Tilden, of Seattle, a franchise to construct and operate an electric lighting and power plant in Hoquiam will be submitted to the voters.

PORT TOWNSEND, WASH.—The Board of County Commissioners has granted James P. Holman, of Port Townsend, a 25-year franchise to erect and operate electric transmission lines over certain streets and highways in Jefferson County.

SEATTLE, WASH.—Arrangements have been made by the Board of Commissioners of King County with the city of Seattle whereby electricity for lighting the new county court house will be obtained from the municipal electric-light plant.

SPOKANE, WASH.—The Commissioners of Spokane County have granted the Little Spokane Lt. & Pwr. Co., of Spokane, a franchise to erect a transmission line from Deer Park to the property of the Arcadia Orchards Co.

CANYON CITY, ORE.—The Prairie Lt. & Pwr. Co. is planning to construct a 700-hp power plant near Canyon City and to erect a transmission line to John Day to supply power for the large dredge which is being installed on Canyon Creek.

SALEM, ORE.—The city of Salem has awarded the Portland Ry., Lt. & Pwr. Co., of Portland, a contract for lighting the streets of the city for a period of five years. The company will replace the arc lamps now in use with 400-cp incandescent lamps.

TILLAMOOK, ORE.—The Coast Pwr. Co., of Tillamook, has recently completed the installation of a 500-kw Curtis steam turbine and is now extending its transmission lines north to connect with the resorts along Tillamook beaches. C. J. Edwards is manager.

HARRISON, CAL.—Preparations are being made by the Victor Pwr. & Development Co. to begin work on construction of a hydroelectric power plant, which will replace the plant now in service.

MILPITAS, CAL.—The Council has adopted plans and specifications for lighting district and authorized the clerk to advertise for bids for lighting same, which will be opened June 21.

PASADENA, CAL.—Within the next six months the city of Pasadena expects to install one 50-kw constant-current transformer and switchboard for same in the municipal electric-light plant; also meters and wire for regular connections, etc. Material has already been purchased for 3 miles of line for extension into annexed district. C. W. Koiner is general manager.

SAUSALITO, CAL.—The Council has authorized the town engineer to prepare plans and estimates for the installation of conduits and electroliers in certain streets in Sausalito.

KINGMAN, ARIZ.—Within the next 30 days the Desert Pwr. & Wtr. Co., of Kingman, expects to purchase and erect wire, poles, wishbone arms, insulators, etc., for a 44,000-volt transmission line from the Tom Reed Mine, in Oatman, to the Orion Mining & Milling Co.'s plant near Oldtrails, Ariz. R. W. Wilde, of Milwaukee, Wis., is vice-president.

BOZEMAN, MONT.—The City Council has adopted a resolution providing for the installation of a street-lighting system on Main Street. The plans provide for the erection of 46 standards carrying five-lamp clusters, and 74 combination lamp and trolley poles; 526 lamps of 60 cp will be used. The cost of the system is estimated at $14,737.

POLSON, MONT.—Preliminary surveys have been completed for a 600-hp hydroelectric plant on Roaring Creek, to be erected by J. H. Cline, to supply Polson and vicinity with electricity. Frank F. Faucett is engineer.

LYMAN, WYO.—Plans are being considered for the installation of a municipal electric-light plant and water-works system.

PLATTEVILLE, COL.—The Western Lt. & Pwr. Co., it is reported, has applied for a franchise to supply electricity in Platteville.

PUEBLO, COL.—The Portland Gold Mining Co. is negotiating with the Arkansas Valley Ry., Lt. & Pwr. Co. for electrical service. About 500 hp will be required in motors to operate a hoist and 400 hp to operate compressors.

CONTACT, NEV.—Preliminary work is now under way for the construction of a floating plant, pumping station and power station for the Nevada Copper Mining, Milling & Pwr. Co. The proposed system will supply water and electricity for the company mines and mills and also for the residents of Contact. C. F. Sherman, of Butte, Mont., is consulting engineer.

Canada

BOTHWELL, ONT.—Work, it is reported, will soon begin by the Ontario Hydro-Electric Commission on the installation of a hydroelectric power system in Bothwell, to cost $5,000.

DORCHESTER, ONT.—At an election held recently the by-law providing for the installation of hydroelectric power was carried.

HIGHGATE, ONT.—The installation of a distributing and street-lighting system in Highgate is reported to be under consideration by the City Council.

KINGSTON, ONT.—Tenders, it is reported, will soon be asked for the purchase of a 300-kw alternating-current generator. W. W. Sands is clerk.

LYNDEN, ONT.—The by-law to provide for the construction of a hydroelectric plant in Lynden will soon be submitted to the ratepayers. The cost of the plant is estimated at about $5,000.

MILVERTON, ONT.—The installation of a hydroelectric lighting system in Milverton is under consideration.

NIAGARA FALLS, ONT.—The Canadian-Niagara Pwr. Co., of Niagara Falls, it is reported, will make extensions to its plant in the near future, involving an expenditure of about $1,000,000. The plans provide for the installation of three additional units of 12,500 hp very soon, and before long a fourth will be installed.

OTTAWA, ONT.—Work will soon be started by the Ottawa Improvement Commission on the installation of a new street-lighting system. Concrete posts will be used, which will be installed by day labor. Alexander Stuart is engineer in charge.

ST. GEORGE, ONT.—The by-law providing for the installation of a system (to cost about $6,000) to utilize electricity to be supplied by the Hydro-Electric Power Commission has been passed.

THAMESVILLE, ONT.—The by-law authorizing the town authorities to enter into a contract with the Hydro-Electric Power Commission of Ontario for hydroelectric power for the town has been passed by the ratepayers.

SHAWINIGAN FALLS, QUE.—Work will soon begin by the Shawinigan Wtr. & Pwr. Co., Power Building, Montreal, on the erection of a transmission line from Shawinigan Falls to the city of Quebec.

Miscellaneous

ST. JOHNS, N. F.—The establishment of a large industry at the Bay of Islands for the manufacture of chemicals, wood pulp and lumber is proposed by an agreement to be made by the Newfoundland government with the Newfoundland Products Corpn., represented by T. L. Wilson, of Woodstock, Ont., with whom is associated the Reid Newfoundland Co. The cost of the sawmills is estimated at $212,000, and that of the sulphite mills, electrolytic bleaching plants and works for the manufacture of wood preparations at $1,600,000.

PANAMA—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until June 25 for furnishing steel, iron, wire cable, wire, cable clips, chain links, brass tubing, etc. Blanks and general information relating to this circular (No. 924) may be obtained at the above office or from the assistant purchasing agents, 24 State Street, New York, N. Y.; 614 Whitney-Central Building, New Orleans, La., and Fort Mason, San Francisco, Cal.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED JUNE 1, 1915.

[Prepared by Mitchell & Allyn, 41 Park Row, New York.]

1,141,107. TELEPHONE TRANSMITTER; W. W. Dean, Chicago, Ill. App. filed Jan. 27, 1902. Granular carbon carried by the diaphragm.

1,141,109. ELECTROPNEUMATIC BRAKE FOR RAILWAY CARS; J. S. Doyle, New York, N. Y. App. filed April 23, 1910. Automatic in emergencies.

1,141,117. METHOD OF REDUCING COKE TO PRODUCE BATTERY CARBONS; H. T. Johnson (deceased), New York, N. Y. App. filed Feb. 3, 1913. Air and agitation.

1,141,119. INDICATING RELAY; W. Kaisling, Chicago, Ill. App. filed July 5, 1913. Electromagnetic shutter type.

1,141,120. CASING CAP FOR LAMP SOCKETS; C. J. Klein, Milwaukee, Wis. App. filed Nov. 15, 1911. Heavy dome and light rib.

1,141,121. SEPARABLE CONNECTOR FOR ELECTRICAL CONDUCTORS; C. J. Klein, Milwaukee, Wis. App. filed Jan. 13, 1913. Inter-fitting insulating parts.

1,141,127. ELECTRIC SIGNAL; J. Lievre, Corpus Christi, Tex. App. filed Feb. 5, 1915. Gas-engine water-jacket alarm apparatus.

1,141,133. GAS-TIGHT SEAL; K. Mensing, Hanau, Germany. App. filed Oct. 30, 1913. Liquid chamber.

1,141,147. RAILWAY-SIGNAL APPARATUS; C. F. Rumold, Berea, Ky. App. filed Aug. 12, 1913. Automatic block type.

1,141,154. MOTOR CONTROLLER; L. L. Tatum, Milwaukee, Wis. App. filed Jan. 8, 1913. Reversal and control of plural motors.

1,141,158. BLOW-OUT DEVICE FOR ELECTRIC-PUMP GOVERNORS; W. V. Turner, Edgwood, Pa. App. filed Nov. 20, 1908. Applies to the switch of a pressure governor.

1,141,174. ELECTROMAGNETIC SWITCH; L. G. Copeman, Flint, Mich. App. filed July 28, 1911. Automatic, for electric cooker.

1,141,175. ELECTRIC STOVE; L. G. Copeman, Flint, Mich. App. filed April 18, 1913. Detachable oven.

1,141,176. ELECTRICALLY HEATED OVEN; L. G. Copeman, Flint, Mich. App. filed Jan. 23, 1914. Detachable heater unit.

1,141,187. ELECTRIC ALARM BELL; G. A. Huber, New York, N. Y. App. filed May 16, 1912. Magnet construction.

1,141,197. ELECTRICAL HEATER; A. S. Mack, Klamath Falls, Ore. App. filed Oct. 29, 1914. Removable heating element.

1,141,199. THREE-PHASE TRANSFORMER; W. S. Moody, Schenectady, N. Y. App. filed April 3, 1906. Forced oil circulation.

1,141,216. ELECTRICAL RECORDING APPARATUS; A. L. Sohn, Chicago, Ill. App. filed Oct. 5, 1912. Elapsed timekeeping system.

1,141,251. PLATE FOR SECONDARY BATTERIES; J. O. Luthy, San Antonio, Tex. App. filed July 7, 1914. Porous enamel grid.

1,141,279. TELEPHONE APPARATUS; T. Smith, Chicago, Ill. App. filed Aug. 14, 1905. Adjustable bracket.

1,141,300. CIRCUIT-BREAKER; B. F. Bailey, Ann Arbor, Mich. App. filed Aug. 15, 1912. Spark ignition distributer.

1,141,307. THERMO-ELECTRIC REGULATING SYSTEM; G. N. Blanchard, San Francisco, Cal. App. filed Dec. 2, 1912. Cold storage; Bourden tube.

1,141,327. AUTOMATIC BURGLAR-ALARM SYSTEM; L. H. German, Louisville, Ky. App. filed June 4, 1914. Mechanical arrangement.

1,141,336. MAGNETO; P. Hamm, Milwaukee, Wis. App. filed Oct. 17, 1913. Flywheel ignition.

1,141,344. AUTOMATIC WHISTLING DEVICE; G. J. Juntunen, Dollar Bay, Mich. App. filed Aug. 6, 1913. Railroad-crossing alarm.

1,141,352. SEMI-AUTOMATIC TELEPHONE-EXCHANGE SYSTEM; F. R. McBerty, New Rochelle, N. Y. App. filed Oct. 24, 1910. Covers selective, sending and calling apparatus.

1,141,359. SWITCH BOX; A. C. Power, Pendleton, Ore. App. filed Sept. 19, 1910. Interior and face-plate construction.

1,141,363. INSTALLATION PERMITTING OF ELECTRICALLY ACTUATING APPARATUS AT DISTANCE FROM A CENTRAL STATION; E. Schneider, Le Creuzot, France. App. filed March 23, 1911. Gunfire control system, etc.

1,141,367. TELEPHONE - CALL - REGISTERING DEVICE; V. Thompson, Vancouver, British Columbia, Canada. App. filed Oct. 13, 1914. Prepayment apparatus.

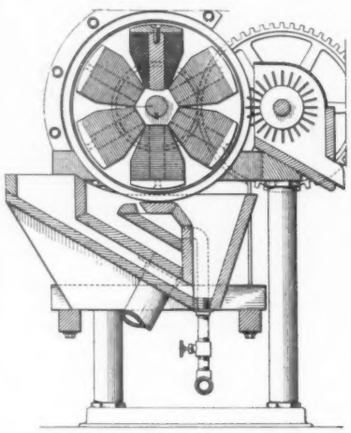
1,141,386. METHOD OF TRANSMITTING AND RECEIVING ELECTRICAL ENERGY; R. A. Fessenden, Brant Rock, Mass. App. filed Aug. 26, 1904. Continuously generated alternating magnetic field.

1,141,387. AERIAL CONDUCTOR; C. S. Franklin, London, Eng. App. filed Dec. 31, 1913. Condenser arrangement.

1,141,400. CAP FOR INCANDESCENT LAMPS; A. Marin, Vitry-sur-Seine, France. App. filed July 8, 1913. Insulating lining.

1,141,402. ELECTROLYTIC APPARATUS EMPLOYING FILMED ELECTRODES; R. D. Mershon, New York, N. Y. App. filed June 19, 1913. Heat-resistance aluminum electrodes.

1,141,453. APPARATUS FOR THE TRANSMISSION AND RECEIPT OF ELECTRICAL ENERGY; R. A. Fessenden, Brant Rock, Mass. App. filed Aug. 26, 1904. Companion to patent No. 1,141,386.



1,141,833—Magnetic Ore Separator.

1,141,460. ELECTRIC SWITCH; M. Guett, Hartford, Conn. App. filed Feb. 25, 1911. Slow make, quick break.

1,141,474. INDUCTOR GENERATOR; J. L. Milton, Chicago, Ill. App. filed July 16, 1907. For spark ignition.

1,141,484. TERMINAL FITTING FOR ELECTRIC CONDUITS; J. C. Phelps, Springfield, Mass. App. filed Oct. 23, 1912. Pothead construction.

1,141,506. ELECTRICAL SYSTEM OF DISTRIBUTION; W. A. Turbayne, Lancaster, N. Y. App. filed Feb. 15, 1910. Carlighting regulation.

1,141,517. ELECTRICAL WELDING APPARATUS; W. E. Andrews, Bellaire, Ohio. App. filed Nov. 9, 1914. For tube seaming.

1,141,523. ELECTRICAL MEASURING INSTRUMENT; I. W. Brogger, Newark, N. J. App. filed March 22, 1913. Details of D'Arsonval type.

1,141,526. STORAGE-BATTERY CELL; R. N. Chamberlain, Chicago, Ill. App. filed March 23, 1914. Arrangement of positive and negative plates.

1,141,530. TREATMENT OF IRON; A. V. Dismore, County of Buckingham, England. App. filed Jan. 31, 1914. Malleability, ductility and tensile strength altered electrolytically.

1,141,548. CONTROLLING DEVICE FOR MOTORS; F. Hymans, Shaler Township, Allegheny County, Pa. App. filed April 10, 1911. Automatic acceleration, etc.

1,141,576. ELECTRIC-HEATING DEVICE; E. J. Ovington, Brookline, Mass. App. filed June 4, 1912. Automatic cut-out.

1,141,583. WINDING MACHINE; C. Ryden, Cranston, R. I. App. filed April 18, 1913. Traverse mechanism for electric coils.

1,141,598. CIRCUIT-WIRE TERMINAL; A. A. Ziegler, Boston, Mass. App. filed Feb. 6, 1912. One-piece formation.

1,141,634. TUBULAR ELECTRIC POCKET LAMP; G. P. Heinrich, Brooklyn, N. Y. App. filed Jan. 28, 1915. Circuit closer.

1,141,637. ELECTRIC-LIGHT FIXTURE AND THE LIKE; W. D. Herwig, Jr., Chicago, Ill. App. filed Aug. 28, 1914. Bracket construction.

1,141,642. ELECTRICAL MEASURING APPARATUS; O. A. Knopp, Oakland, Cal. App. filed Jan. 11, 1912. For alternating current.

1,141,647. MEANS FOR CONTROLLING FLOW OF FLUIDS; L. A. Merk, Pittsburgh, Pa. App. filed Nov. 24, 1909. Electric-motor-driven valve.

1,141,655. ELECTRIC- RAILWAY SYSTEM; W. Robinson, Brooklyn, N. Y. App. filed Aug. 1, 1904. Block control.

1,141,674. SAFETY DEVICE; F. P. Withers, Chicago, Ill. App. filed Dec. 29, 1913. Lineman's guard.

1,141,686. ATTACHMENT PLUG; E. D. Jones, Moline, Ill. App. filed May 7, 1914. Spring plunger type.

1,141,701. VEHICLE INDICATOR; P. H. Fielding and F. E. Lewis, 2d, Saugatuck, Conn. App. filed April 8, 1913. Rear light.

1,141,717. TRANSMITTING INTELLIGENCE BY RADIANT ENERGY; J. W. Lee, Brooklyn, and J. L. Hogan, Jr., West Rockaway, N. Y. App. filed Nov. 16, 1912. Wireless receiver and amplifier.

1,141,729. RECORDING INSTRUMENT FOR WATTMETERS; S. B. Storer, Syracuse, N. Y. App. filed Oct. 3, 1906. Graphic record of rotation.

1,141,740. ELECTRIC DISPLAY BOARD; N. L. Wine, Fort Myers, Pa. App. filed Nov. 25, 1914. For reproducing drawings, etc.

1,141,751. PRINTING-TELEGRAPH SYSTEM AND ALPHABET; C. G. Ashley, Chicago, Ill. App. filed May 27, 1912. Special automatic transmission.

1,141,752. SECONDARY CLOCK MOVEMENT; F. S. Atkinson, Brookline, Mass. App. filed Nov. 12, 1913. Locking and release movement.

1,141,764. DRIVING MECHANISM OF VEHICLES; J. Buchli, Baden, Switzerland. App. filed Aug. 19, 1912. Plural motor drive.

1,141,803. ELECTRIC SWITCH; F. Kemerer, Kersey, Pa. App. filed Oct. 8, 1912. For turbine pump.

1,141,820. LIQUID-LEVEL ALARM APPARATUS; L. Mozolan, Montgomery, Ala. App. filed June 5, 1914. For refrigerator drip pans, etc.

1,141,823. TELEPHONE SIGNAL; E. H. Osborn, Sauk Center, Minn. App. filed March 5, 1914. For simultaneously signaling several stations.

1,141,833. MAGNETIC ORE SEPARATOR; S. R. Salwen, Grangesberg, Sweden. App. filed Oct. 9, 1914. Cylindrical drum type.

1,141,836. DEVICE FOR WORKING WEAK-CURRENT INSTALLATIONS; F. Schrotter, Wilmersdorf, Germany. App. filed Feb. 20, 1914. For storage-battery bell installation, etc.

1,141,847. PRESSURE-CONTROLLED ELECTRIC SWITCH FOR MOTOR-OPERATED PUMPS; S. S. Stahl, Connellsville, Pa. App. filed April 21, 1914. Automatic quick opening and closing.

1,141,850. IMAGE TRANSFORMER FOR DISTANCE PHOTOGRAPHY; C. Stille, Zehlendorf-West, Germany. App. filed April 22, 1913. Polarized light and magnetic field.

1,141,860. ELECTRIC MOTOR OR GENERATOR; H. A. Balcome, Boston, Mass. App. filed Oct. 24, 1910. Air cooling of inclosed construction.

1,141,866. TELEPHONE PAY STATION; G. Christian, Detroit, Mich. App. filed Sept. 9, 1911. Coin detector.

1,141,868. AUTOMATIC TELEGRAPHY; P. B. Delany, South Orange, N. J. App. filed Dec. 29, 1908. Edge contact through perforated tape.

1,141,888. PORTABLE ELECTRICALLY HEATED RADIATOR; G. Schmidt, Spokane, Wash. App. filed May 12, 1913. Tubular water container.